

Assessment of Biological Embodiment by Foldscope

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ABSTRACT

In developing country like India, teaching science and learning needs huge investment. Resources are limited and hence the Indo-Us project by Dr. Manu Prakash inspired many young minds by developing Foldscope In 2012. Through the production of low-cost tools to community around the world, they aim to break down cost barrier between people & curiosity and excitement of scientific exploration. It can be used as an education tool to make science learning as fun. It brings Microscopy to new place. It is designed to be durable, portable, and make science more accessible to everyone. The present study evaluated the use of foldscope to observe microbes and plant specimen within KME society campus where the observation reveals the presence of beautiful creatures. Like tardigrades, amoeba, Euglena etc along with the plant tissue. Using Foldscope with smartphone documentation qualitative and quantitative were carried out at Department of Biotechnology, GM Momin Women's College, Bhiwandi during 2019-20. Viewing microbes under foldscope was delightful experience that doesn't have to cost a ton of money. It also provides new opportunities to field worker and people who want to explore beauty of nature. The extra ordinary feature of this microscope is that it can attached to Smartphone and use to capture photo and video's in real time which is hard task in other microscope on field and in laboratory at ease.

Keywords: Foldscope, microbes, curiosity, science learning, Indo-Us project.

INTRODUCTION

Invention of microscope changed the perspective of humans towards nature. Most microscopes are rather expensive and, therefore, often beyond the reach of many students and institutions. An affordable and sturdy microscope was developed by Dr. Manu Prakash and his team at Stanford University (USA) in 2012 (Cybulski et al., 2014), which can provide a magnification from 140x to 2000x with submicron resolution. This "Foldscope" microscope is made of paper and uses the principle of "Origami". Although punched only on a flat sheet of paper, it is robust enough for field study and because of its low cost; it can reach in resource-limited conditions (Neikha et al., 2020; Walling et al., 2020).

With the intend of science for all and utility of foldscope, KME society's G.M.Momin Womens college Bhiwandi in the year 2018 received the DBT grand under Indo-US project Department of Biotechnology with the motive of conducting research work, innovative teaching learning, trained and encouraged the student towards science exploration.

Here in this paper the part of work done is highlighted which discuss about the observation of various micro-flora and fauna within the vicinity of college which gives motivation to perform field study and in lab observation of beautiful microscopic world.

METHOD

Foldscope is ready to use in three easy steps.

- First Involve assembling toldscope unit by Joining together different pieces from flat sheet provided in foldscope kit
- Second focuses on working sample.
- Third capture Image of Object using Smart phone coupled to foldscope.

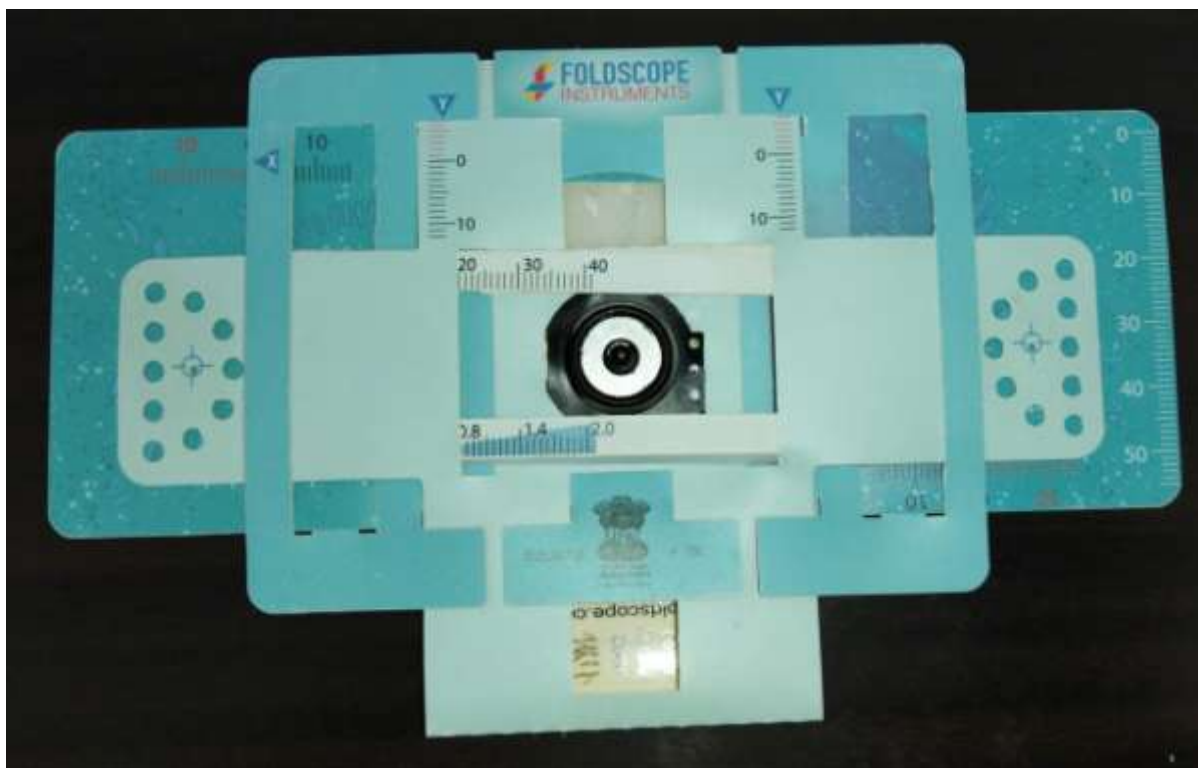


Fig 1: (Assembled Foldscope)

Sample preparation:

Sampling Involves mounting a deep of specimen (water) on slide and covering it with a glass cover slip.

Slide Insertion and Focusing:

The slide is Inserted within slide pocket upside down (towards yellow side). Focusing of mounted object can be adjusted in Simple way by sliding paper platform with thumb and forefinger.

Viewing:

There are three methods to view the samples. First, the sample can be viewed directly through the eyes. Second, it can be viewed through the camera of mobile phones. To view a sample with a phone, attach a magnetic coupler (provided in kit) over the lens of your phone camera- by using either a double-sided ring sticker or with any other tape. Foldscope's lens has a magnification of 140x, and that magnification is multiplied by the zoom feature of the his mobile phone. It is ideal for recording the movements of living specimens by using the video feature of the mobile phone. In the third method, a sample can be projected on a white screen or surface in a dark room. Projection requires a strong light source. A phone's flashlight can also be used. For this, attach a magnetic coupler over the phone's flashlight, and then bring phone's flashlight up to the aperture, on the yellow side of Foldscope. Turn on the flashlight, an image of the specimen will be visible on the screen.

RESULTS

With a keen observation of water sample and plant tissue using foldscope for the study, following images were capture and imaged through smart phone (Redmi note 7 pro).

Table 1: Number of organisms observed during study

Sr No	Sampling Site	Paramacium	Tardigrades
1	KMES Campus	19	07
2	Arif Garden	08	05
3	Samad Nagar Pond	33	25



Fig 2: Tardigrades (Water bear)

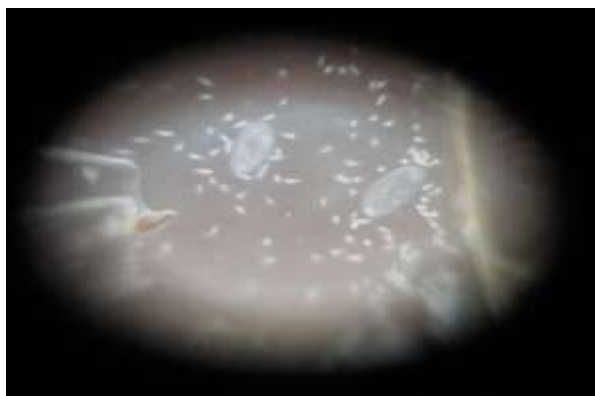


Fig 3: Paramecium



Fig 4: Protozoa



Fig 5: Protozoa



Fig 6: Plant tissue



Fig 7: Plant tissue

CONCLUSION

In view of all experiment perform using this paper microscope, it gives us an idea that foldscope can be used as a basic research tool, teaching learning platform and as self learning practices for curious mind. It is also useful to study within classroom with every student having an opportunity to touch, experience, hold. thus laying the foundation for critical thinking. This cheap tool can facilitate practical of biology because of its portability. The growing access to internet across the country can make mobile phone foldscopy a promising technology.

It is a portable microscope with easy accessibility and availability without power and energy requirement and zero maintainanace cost. Foldscope is truly amazing device but it won't replace conventional microscope. Despite its several advantages foldscope has certain limitations. Although a Foldscope is ideal for viewing sub ellular structures, its resolution is still relatively low as compared to the power of compound microscopes. It has a very small focus range so image analysis is difficult. For on-site biological fluid sampling, staining and sample preparation can be major limiting factor.

As foldscope began with an idea to make science more accessible to everyone. So, Whether you are teacher, scientist, researcher, hiker, nature traveller, photographer and curious Cat, with foldscope in your pocket you can better explore beauty of nature around you.

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