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Mobile Macrophotography

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Abstract

Although it is relatively easy to purchase a good quality digital camera with the facility to take ‘macro’ photographs of very small objects, such a camera may not always be available when needed. However, most people now have access to a mobile phone with a camera facility. Here it is demonstrated that quite useful digital photos can be taken of very small objects such as insects with an average mobile phone camera utilising a small inexpensive hand lens. Examples of such photos are given, along with the pros and cons of each hand lens tested and some tips on their use with mobile phones.

Introduction

It seems fewer people carry ‘proper’ cameras around with them these days, even in circumstances where photographs might be expected to be taken. Many people now rely on mobile phones with in-built digital cameras. Unfortunately, although mobile phones can be useful for general photography and are improving in quality all the time, they can rarely take photos at a short focal range, and anything smaller than A5 size can be very difficult to photograph. Some modern digital cameras do not even have a ‘macro’ facility. However, the lenses on mobile phones are usually tiny (c. 5 mm diameter), and people interested in natural history often have a magnifying glass or hand lens which will fit comfortably over the lens on the back of a mobile. Depending on the phone and the magnifying glass used, this can provide effective results. While the images may not be of publishable quality, this can be a useful way to photograph very small things when a decent digital camera or microscope is not to hand – for instance when an insect is seen whilst out in the field but not captured, or to record a small specimen or label found whilst visiting another museum’s natural history collection. Those with a camcorder facility on their mobile phone will find they can make short videos this way as well. Some test shots were taken of two subjects using three different hand lenses and a mobile phone, and for comparison purposes the same photos were taken with a *Nikon* digital camera on a macro setting. Example images are shown below, along with details of the three magnifiers used.

Materials

Mobile phone: *Motorola Defy*, with a 5 megapixel camera with autofocus and image stabilization (also a camcorder VGA@30fps), manufactured in 2010. Not the best mobile phone camera but adequate although it does not offer touch focus so the user does not have complete control over what part of the image is in focus. Nevertheless, good normal photographs and useable macro photographs have been captured with this phone. Other mobile phones may work even better with hand lenses and magnifiers and experimentation is encouraged.

Digital camera

Nikon Coolpix 4500. 4 megapixel, manufactured in 2002. Used on macro setting.

Magnifying glasses

- A x5 magnifier from the Natural History Museum, London (NHM) shop with a lens diameter of 28 mm (Fig. 1). This is a great little inexpensive hand lens. It is kept inside the plastic cover but pops out at the touch of the button on the side.
- *Triplet* magnifier from United Kingdom Geologists Equipment (UKGE) provides a choice of two lenses: x10 and x20, the lenses being 18 mm and 12 mm diameter respectively (Fig. 2).
- A standard domestic magnifying glass, of approximately x5 magnification, of unknown make and provenance and lens diameter 50 mm (Fig. 3).



Fig 1. A x5 magnifier from the Natural History Museum, London (NHM) shop with a lens diameter of 28 mm.



Fig 2. Triplet magnifier from United Kingdom Geologists Equipment (UKGE) provides a choice of two lenses: x10 and x20, the lenses being 18 mm and 12 mm diameter respectively.



Fig 3. A standard domestic magnifying glass, of approximately x5 magnification, of unknown make and provenance and lens diameter 50 mm.

Specimens

- Greenbottle (*Lucilia* sp.) (Figs 4-7). This particular greenbottle is a very poor specimen, it is not the fault of the photography (this and the owl pellet are from the entomology collection of the author's daughter).
- Owl pellet with beetle remains (unknown species) (Figs 8-11).
- 22-spot ladybird (*Psyllobora vigintiduopunctata*) (Fig. 12).

Results

See Figs 4-12. All the photos have been cropped.



Fig 4. *Lucilia* sp. greenbottle, taken using a Nikon Coolpix 4500 digital camera on macro



Fig 5. *Lucilia* sp. greenbottle, taken using a Mobile phone and NHM x5 lens.



Fig 6. *Lucilia* sp. greenbottle, taken using a Mobile phone and Triplet x10 lens.



Fig 7. *Lucilia* sp. greenbottle, taken using a Mobile phone and domestic lens approx x5.



Fig 8. Owl pellet (c. 18 mm across) taken using a Nikon Coolpix 4500 digital camera on macro setting.

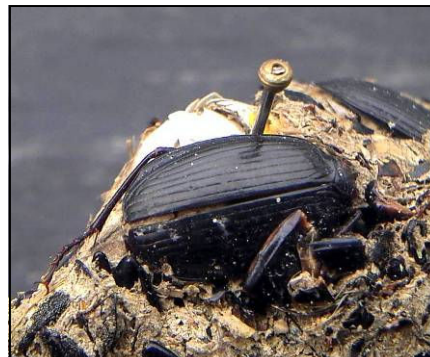


Fig 9. Owl pellet (c. 18 mm across) taken using a mobile phone and NHM x5 lens



Fig 10. Owl pellet (c. 18 mm across) taken using a mobile phone and Triplet x10 lens.



Fig 11. Owl pellet (c. 18 mm across) taken using a mobile phone and domestic lens approx

Discussion

In a way, it is unfair to compare the results from the *Nikon* digital camera to the images taken with the mobile phone and hand lenses for two reasons. Firstly, the *Nikon* camera – though made in 2002 – is a dedicated digital camera with a specific macro facility, rather than a mobile phone that happens to have a camera built into it. Secondly, the *Nikon* camera was on a tripod and the timed shutter release facility was used, minimising camera shake, whereas the mobile phone was used without a tripod and whilst trying to hold the magnifier steady underneath it. Nevertheless, it is very interesting to see that all the photos taken turned out to be useful, in that the specimens in the image could be identified relatively easily. As the depth of field is shallow it is difficult to compare the images exactly as slightly different parts of the subject are in focus each time. Despite not using a tripod for the mobile phone, it would be difficult at first glance to say which of these images were taken with the *Nikon* camera other than the background was white when the *Nikon* was used, whereas the mobile phone did not cope well with such contrast so the background was changed. Also, the depth of field appears to be shallower when using the mobile phone.



Fig 12. *Psyllobora vigintiduopunctata* (22-spot ladybird) (c. 4 mm in length). Mobile phone and NHM x5 lens.

The ‘household’ magnifier (Fig. 3) was very easy to use as it had the widest lens and therefore was easy to position under the lens of the mobile phone. When using the *Triplet* magnifier lenses (Fig. 2), care had to be taken that the whole hand lens was held steady and was positioned very accurately, or the edge of the small lens appeared in the photos. The shape of the hand lens as a whole, as well as the small size of the lenses, made this magnifier the most difficult to use. It did however provide the greatest amount of magnification. The x20 lens was so small that it was almost impossible to use without the edges appearing in the picture, and only the very centre of the image did not suffer from distortion. The x5 magnifier from the NHM is perfect for using with a mobile phone as both the lens and its cover are flat and wide and are easily held in position against the back of a mobile phone. Being very light, it can also be held in place easily with masking tape or an elastic band.

The 22-spot ladybird (Fig. 12) was seen at the house of a friend, and the mobile phone and (NHM) x5 hand lens were genuinely the only items close enough to hand to be used to photograph the insect before it was attacked by a house spider and dragged into a tiny gap in the skirting board (if only the camcorder facility was being tested rather than the camera!). There was no time to get a ‘proper’ camera to record the specimen, so this genuinely shows the usefulness of knowing that photographs of such a small specimen (4 mm across) can be taken in this way. It is less detailed than the other photos as the insect was moving. Also, getting down on the floor right by the skirting board to get close enough to take the photograph without blocking all the available light was a little difficult.

Admittedly, the depth of field can be very limited and if outdoors in bright sunshine it can be difficult to clearly see the screen of the mobile phone, but the autofocus tends to work well even though it is focusing through another piece of glass. With small hand lenses, care has to be taken that the magnifier is held steady and is positioned accurately, or the edge of the lens can appear in the photos. Also, the middle of the image is more in focus than the outer parts of the image. But useful photographs can still be taken of surprisingly small specimens, as a simple record of what has been seen.

Conclusions

The images presented here are not necessarily impressive but they are simply to demonstrate that recognisable photographs of some limited use can be taken this way, with a variety of hand lenses – which is quite useful to know. With practice, much better images would be obtained.

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