Appendix

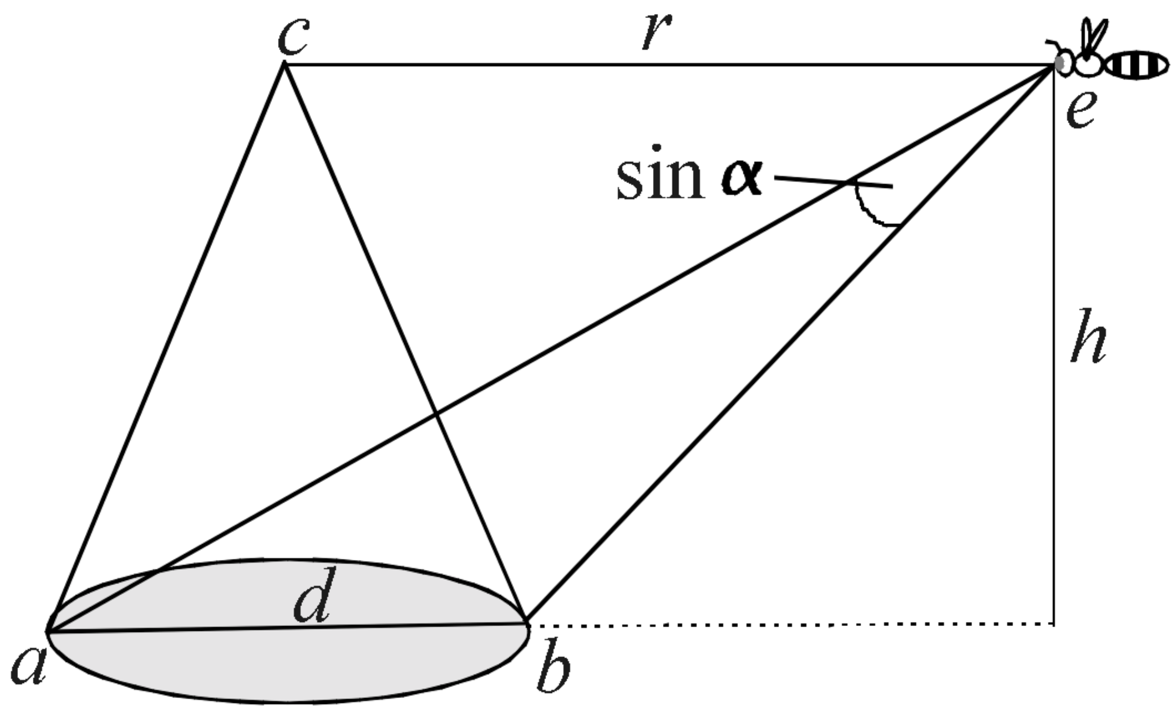

Fig. 6. This sketch illustrates the geometry necessary to calculate the radius of the detection area *r*, within which a bee flying at a given height *h* will be able to detect a flower with diameter *d*, given a resolution of α ≥5° (α ≥15° for the color recognition area).

In the first step, we calculate the triangle Δ*abe* by

$$\frac{dh}{2} = \tfrac{1}{2}\left[\overline{ae}\right]\left[\overline{be}\right]\sin\alpha; \qquad [A1]$$

where

$$\left[\overline{ae}\right] = \sqrt{h^2 + \left(r + \frac{d}{2}\right)^2} \qquad [A2]$$

and

$$\left[\overline{be}\right] = \sqrt{h^2 + \left(r - \frac{d}{2}\right)^2}\ . \qquad [A3]$$

Now we insert Eqs. A2 and A3 in A1:

$$\frac{dh}{2} = \tfrac{1}{2}\sqrt{h^2 + \left(r + \frac{d}{2}\right)^2}\,\sqrt{\mathrm{h}^2 + \left(\mathrm{r} - \frac{\mathrm{d}}{2}\right)^2}\,\sin\alpha. \qquad [A4]$$

We square both sides,

$$\left(\frac{dh}{\sin\alpha}\right)^2 = \left[h^2 + \left(r + \frac{d}{2}\right)^2\right]\left[h^2 + \left(r - \frac{d}{2}\right)^2\right] = h^4 + 2h^2\left(r^2 + \frac{d^2}{4}\right) + r^4 - r^2\frac{d^2}{2} + \frac{d^4}{16}, \qquad [A5]$$

and replace r^2 by y,

$$\left(\frac{dh}{\sin\alpha}\right)^2 = h^4 + 2h^2\left(y + \frac{d^2}{4}\right) + y^2 - y\frac{d^2}{2} + \frac{d^4}{16}. \qquad [A6]$$

In the next step, we solve the quadratic equation for y:

$$y_{1/2} = -\frac{2h^2 - \frac{d^2}{2}}{2} \pm \sqrt{\frac{\left(2h^2 - \frac{d^2}{2}\right)^2}{4} - \left(h^4 + h^2\frac{d^2}{2} + \frac{d^4}{16} - \left(\frac{dh}{\sin\alpha}\right)^2\right)}. \qquad [A7]$$

Finally, we calculate r by

$$r = \sqrt{|y|}. \qquad [A8]$$