

## 5.4. Principal components to reduce the number of explanatory variables

With an increasing number of explanatory variables (related or not-related, similar or dissimilar units) in one experiment, multivariate statistics may be of interest. Multivariate statistics are widely used in ecology ([Leps and Smilauer, 2003](#)), but less often in bee research. Multivariate statistics can be used to reduce the number of response variables without losing information in the response variables ([van Dooremalen and Ellers, 2010](#)), or to reduce the number of explanatory variables (especially valuable if they are correlated). A Principle Component Analysis (PCA) can be used to examine, for example, morphometric or physiological variables (such as protein content of different bee body parts or several volatile compounds in the head space of bee brood cells). The PCA is usually used to obtain only the first principal component that forms one new PC variable (the axis explaining most variation in your variables). The correlations between the original variables and the new PC variable will show the relative variation explained by the original variables compared to each other and their reciprocal correlation. The new PC variable can then be used to investigate effects of different treatments (and/or covariates) using statistics as explained above in [section 5](#). For an example in springtails see [van Dooremalen \*et al.\* \(2011\)](#), or in host-parasite interactions see [Nash \*et al.\* \(2008\)](#). Note that the new PC variables are uncorrelated with each other, which improves their statistical properties. Unfortunately, it is also easy to lose track of what they represent or how to interpret them. However, by reducing dimensionality and dealing with uncorrelated variables one can transform a data set with a great many explanatory and response variables into one with only a few of each, and ones which capture most of the variability (i.e. the underlying processes) in the data set. Related procedures are factor analysis, partial least squares, and PC regression.