Lathyrus ms2: Selection on reaction norms - multivariate modeling for phenotypic selection on plasticity 4 (Arnold et al. 2019 Phil. Trans. R. Soc. B)

Contents

Repeating some models using within-subject centering (van de Pol & Wright 2009).

Within-subject centering of mean April temperature: We substract the id's mean value from each observation value, deriving a new predictor variable (cmean_4_ws) to use as a fixed effect that expresses only the within-subject (within-id) variation component. We then need to derive a second new fixed predictor variable (cmean_4_bs) to express only the between-subject (between-id) variation component, and this is simply the ids' means.

```
data_4yrs<-data_4yrs%>%
  group_by(id)%>%
  mutate(cmean_4_ws=mean_4-mean(mean_4),cmean_4_bs=mean(mean_4))
data_5yrs<-data_5yrs%>%
  group_by(id)%>%
  mutate(cmean_4_ws=mean_4-mean(mean_4),cmean_4_bs=mean(mean_4))
```

Ids with 4 years of data, mean April temperature

```
# Scaling factor for MCMCglmm iterations
sc <- 100#0 # Increase this parameter for longer runs

priorUV2_RR_ws <- list(G = list(G1 = list(V = diag(1), nu = 1),  # other random effect (YEAR)
                             G2 = list(V = diag(2), nu = 1),
                             G3 = list(V = diag(2), nu = 1)),
                        # ^ 2x2 variance-covariance matrix for var in slopes + intercepts
                     R = list(R1 = list(V = diag(1), nu = 2)))

univar.FFD_RR_ws4 <- MCMCglmm(FFD ~ cmean_4_ws + cmean_4_bs,
                        random = ~year + us(1 + cmean_4_ws):id + us(1 + cmean_4_bs):id,
                        rcov = ~units,
                        data = data_4yrs,
                        prior = priorUV2_RR_ws,
                        family = "gaussian",
                        nitt = 1100 * sc, thin = sc, burnin = 100 * sc, verbose = F)
summary(univar.FFD_RR_ws4)
```

```
##
##  Iterations = 10001:109901
##  Thinning interval  = 100
##  Sample size  = 1000
```

```
##
##  DIC: 8575.667
##
##  G-structure:  ~year
##
##      post.mean l-95% CI u-95% CI eff.samp
## year     25.91    12.51    43.53     1000
##
##                ~us(1 + cmean_4_ws):id
##
##                             post.mean l-95% CI u-95% CI eff.samp
## (Intercept):(Intercept).id    1.0258  0.19226   2.0629    879.6
## cmean_4_ws:(Intercept).id     0.5004  0.05163   0.9761   1000.0
## (Intercept):cmean_4_ws.id     0.5004  0.05163   0.9761   1000.0
## cmean_4_ws:cmean_4_ws.id      0.6033  0.18713   1.0006   1000.0
##
##                ~us(1 + cmean_4_bs):id
##
##                             post.mean l-95% CI u-95% CI eff.samp
## (Intercept):(Intercept).id    6.1626  0.11259 30.59177    243.7
## cmean_4_bs:(Intercept).id    -1.1488 -5.33489  0.07101    244.3
## (Intercept):cmean_4_bs.id    -1.1488 -5.33489  0.07101    244.3
## cmean_4_bs:cmean_4_bs.id      0.3085  0.04845  1.07040    250.9
##
##  R-structure:  ~units
##
##       post.mean l-95% CI u-95% CI eff.samp
## units     18.45    16.88    20.01     1149
##
##  Location effects: FFD ~ cmean_4_ws + cmean_4_bs
##
##             post.mean l-95% CI u-95% CI eff.samp  pMCMC
## (Intercept)   72.4453  61.8389  82.1871     1000 <0.001 ***
## cmean_4_ws    -2.4199  -4.1055  -0.8769     1302 <0.001 ***
## cmean_4_bs    -2.5439  -4.3823  -0.7214     1000  0.004 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Ids with 5 years of data, mean April temperature

```
univar.FFD_RR_ws5 <- MCMCglmm(FFD ~ cmean_4_ws + cmean_4_bs,
                        random = ~year + us(1 + cmean_4_ws):id + us(1 + cmean_4_bs):id,
                        rcov = ~units,
                        data = data_5yrs,
                        prior = priorUV2_RR_ws,
                        family = "gaussian",
                        nitt = 1100 * sc, thin = sc, burnin = 100 * sc, verbose = F)
summary(univar.FFD_RR_ws5)
```

```
##
##  Iterations = 10001:109901
##  Thinning interval  = 100
```

```
##  Sample size  = 1000
##
##  DIC: 6537.569
##
##  G-structure:  ~year
##
##      post.mean l-95% CI u-95% CI eff.samp
## year     25.26     11.5    42.16     1000
##
##                ~us(1 + cmean_4_ws):id
##
##                             post.mean l-95% CI u-95% CI eff.samp
## (Intercept):(Intercept).id    1.2243 0.186319    2.644    878.9
## cmean_4_ws:(Intercept).id     0.5568 0.008139    1.159   1000.0
## (Intercept):cmean_4_ws.id     0.5568 0.008139    1.159   1000.0
## cmean_4_ws:cmean_4_ws.id      0.5972 0.167769    1.014   1000.0
##
##                ~us(1 + cmean_4_bs):id
##
##                             post.mean l-95% CI u-95% CI eff.samp
## (Intercept):(Intercept).id    5.2793  0.07071 25.35563    394.9
## cmean_4_bs:(Intercept).id    -0.9642 -4.72135  0.08168    388.2
## (Intercept):cmean_4_bs.id    -0.9642 -4.72135  0.08168    388.2
## cmean_4_bs:cmean_4_bs.id      0.2795  0.05382  0.94870    393.5
##
##  R-structure:  ~units
##
##       post.mean l-95% CI u-95% CI eff.samp
## units     18.68    17.04    20.56    896.9
##
##  Location effects: FFD ~ cmean_4_ws + cmean_4_bs
##
##             post.mean l-95% CI u-95% CI eff.samp  pMCMC
## (Intercept)   71.3326  60.1395  83.0655     1000 <0.001 ***
## cmean_4_ws    -2.3655  -3.8894  -0.7866     1000  0.004 **
## cmean_4_bs    -2.4132  -4.5302  -0.4452     1000  0.026 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

What I understand from van de Pol & Wright 2009: We tested whether either the within-subject effect (cmean_4_ws) or the between-subject effect (cmean_4_bs) is itself significant. As the parameter estimates of these two effects do not seem to differ, we can say that the within- and between-subject effects are effectively the same.