Marauding Lesbia Plots

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```
library(ggplot2)
library(RColorBrewer) # for brewer.pal() color palette
library(cowplot) # for plot_grid()
```

```
##
## Attaching package: 'cowplot'
```

```
## The following object is masked from 'package:ggplot2':
##
##     ggsave
```

```
bandits<-read.csv(file = "/Users/boris/Dropbox/PROJECTS/nectar-robbing/larceny-paper/entered_data/robbe

#should repeat this (below) on:
#(1) original csv data, instead of magic numbers
#(2) separated by Lesbia species

split.bandits <- split(bandits,bandits$bird.genus)
lesbias <- split.bandits$Lesbia
diglossas <- split.bandits$Diglossa
```

We take a look at some summary statistics, mostly by checking tables of the mode of plant-trainbearer interaction, semi-manually extract and re-order levels/factors for that data to later make a bar plot. We also check that there are no unexpected associations with sex (m/f) and species (nuna/victoriae, ignoring uncertain sp. designation).

```
# roughly similar number of L. nuna and victoriae, 19/23 +5 "sp"
table(lesbias$bird.species)
```

```
##
##      nuna       sp. victoriae
##        19         5        23
```

```
# roughly similar number of males and females, 23/24
table(lesbias$bird.sex)
```

```
##
##  f  m
## 24 23
```

```
table(lesbias$visitor.mode)
```

```
##
##  NR NR2   P P/T   T
##  14   5  15   6   1
```

```
lesbia.tally <- data.frame(modes=as.factor(c("R2","R1/R2","T","T/P","P","UNK")),
           obs=c(sum(lesbias$visitor.mode=="NR2",na.rm = T),
          sum(lesbias$visitor.mode=="NR",na.rm = T),
          sum(lesbias$visitor.mode=="T",na.rm = T),
          sum(lesbias$visitor.mode=="P/T",na.rm = T),
```

```
          sum(lesbias$visitor.mode=="P",na.rm = T),
          sum(is.na(lesbias$visitor.mode)))
          )
# This is the total tally for all Lesbias:
lesbia.tally
```

```
##   modes obs
## 1    R2   5
## 2 R1/R2  14
## 3     T   1
## 4   T/P   6
## 5     P  15
## 6   UNK   6
```

```
# Set factors into desired plotting order
lesbia.tally$modes <- factor(lesbia.tally$modes, levels = c("R2","R1/R2","T","T/P","P","UNK"))

# convert observations into percentages
lesbia.tally$perc <- (lesbia.tally$obs/47)*100
```

Now, let's check whether there are sex- or species-dependent associations. We don't expect any, a priori. To facilitate this, we're splitting the visits into two broad catergories: larceny (NR1,NR2,T, and any combinations thereof) and pollination (P,P/T).

Why is P/T listed as a pollination? because we cannot rule it out as a pollination and that classification is conservative with respect to our main argument—there is a *lot* of larceny going on, about 50% of all visits.

```
#Check whether there are sex-dependent differences
les.sex.not.na<-complete.cases(lesbias[,c(3,6)])
temp2 <- lesbias[,c(3,6)][les.sex.not.na,]
table(split(temp2,temp2$bird.sex)$m)
```

```
##         visitor.mode
## bird.sex NR NR2 P P/T
##        m  9   4 5   4
```

```
table(split(temp2,temp2$bird.sex)$f)
```

```
##         visitor.mode
## bird.sex NR NR2  P P/T  T
##        f  5   1 10   2  1
```

```
les.by.sex <-
matrix(c(13, 7, 9, 12), #these were manually added from above lines
       nrow = 2,
       dimnames =
       list(c("male", "female"),
            c("larceny", "pollination")))

les.by.sex
```

```
##        larceny pollination
## male        13           9
## female       7          12
```

```
fisher.test(les.by.sex)
```

```
##
```

```
##  Fisher's Exact Test for Count Data
##
## data:  les.by.sex
## p-value = 0.2146
## alternative hypothesis: true odds ratio is not equal to 1
## 95 percent confidence interval:
##   0.5951889 10.5734275
## sample estimates:
## odds ratio
##   2.420267
```

```
#Check whether there are spp-dependent differences
les.sex.not.na<-complete.cases(lesbias[,c(2,6)])
temp3 <- lesbias[,c(1,2,3,6,7)][les.sex.not.na,]
nun <- split(temp3,temp3$bird.species)$nuna
vic <- split(temp3,temp3$bird.species)$victoriae
table(nun$visitor.mode)
```

```
##
##  NR NR2   P
##   6   3   9
```

```
table(vic$visitor.mode)
```

```
##
##  NR NR2   P P/T   T
##   8   2   4   5   1
```

```
les.by.sp <-
matrix(c(9, 11, 9, 9), #these were manually added from above lines
       nrow = 2,
       dimnames =
       list(c("nuna", "victoriae"),
            c("larceny", "pollination")))

les.by.sp
```

```
##           larceny pollination
## nuna            9           9
## victoriae      11           9
```

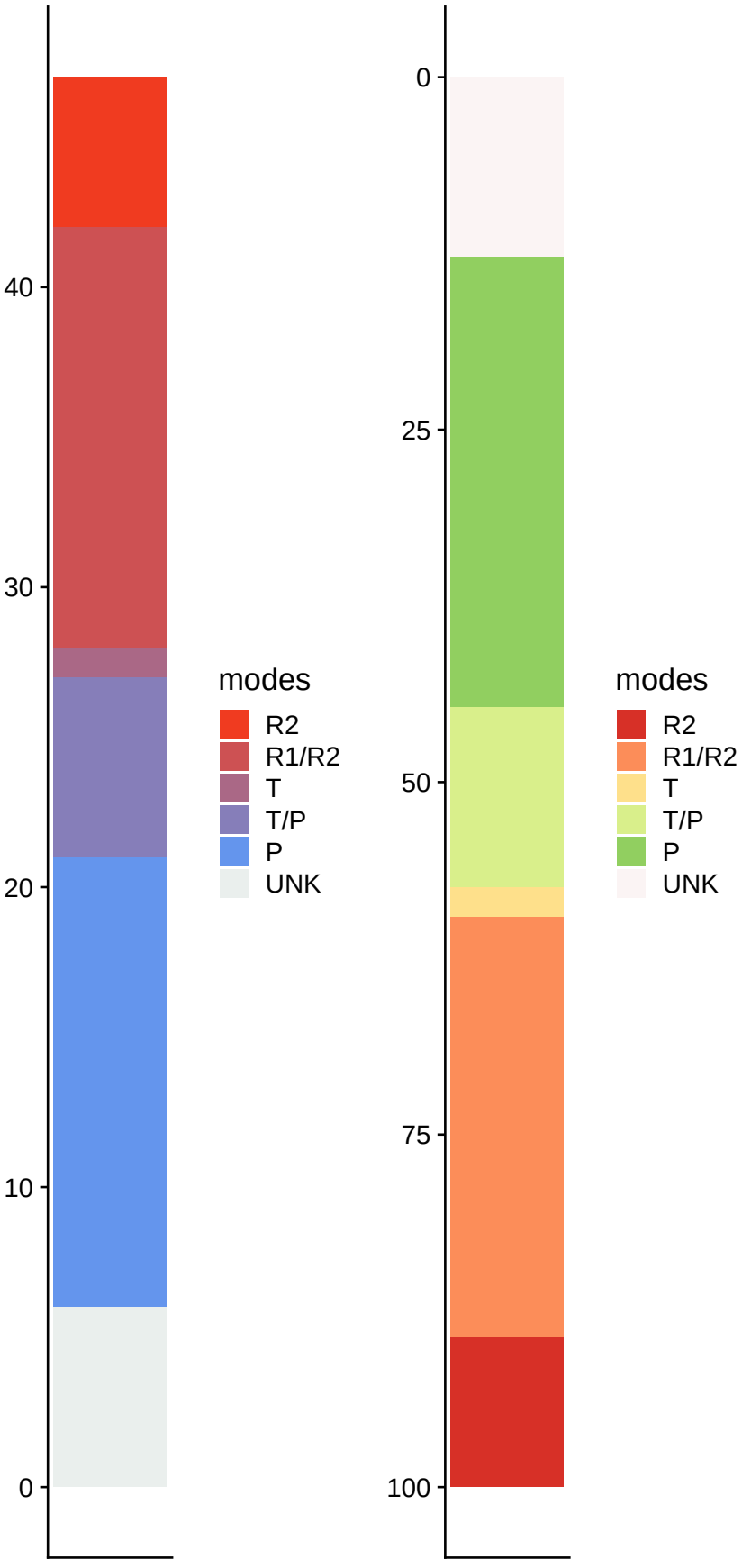
```
fisher.test(les.by.sp)
```

```
##
##  Fisher's Exact Test for Count Data
##
## data:  les.by.sp
## p-value = 1
## alternative hypothesis: true odds ratio is not equal to 1
## 95 percent confidence interval:
##  0.1901054 3.5096824
## sample estimates:
## odds ratio
##  0.8225279
```

```
#this is old test code of manually entered numbers
#boids <- data.frame(sp=as.factor(c("NR2","NR1/NR2","T","T/P","P")), obs=c(5,14,1,4,13))
```

Here is the first plotting attempt with red:blue:white scheme, red:yellow:green scheme and varying observation counts/percentages along with y-axis flip.

```
# Colors for plotting
# this is a good red, #f03b20, ("#FEEACCFF") but the result with white is very porky flesh. Looks like
# '#e6550d' with '#FEEDDDFF' looks pretty good, because it's orangey
# red to blue? #f03b20 to #a6bddb
# scale_fill_manual(values=brewer.pal(n=6, name='RdYlGn')) <-- this is great, but
# it needs a sixth white/off-white color added for "Interaction cannot be determined"

##f03b20, ("#FEEACCFF"
lesbia.col <- colorRampPalette(c('#f03b20','cornflowerblue')) # reddish to blueish
lesbia.cols <- alpha(lesbia.col(5))
RBW6 <- c(lesbia.cols,'#EAEFEDFF')

# First plotting attempt with red:blue:white and observation counts, not percentages
p1 <- ggplot(lesbia.tally, aes(1, obs, fill=modes)) +
  geom_bar(data=lesbia.tally,stat="identity") +
  scale_fill_manual(values=RBW6) +
  theme(axis.title.x=element_blank(),
        axis.text.x=element_blank(),
        axis.ticks.x=element_blank(),
        axis.title.y=element_blank(),
        panel.grid.major = element_blank(),
        panel.grid.minor = element_blank(),
        panel.background = element_blank())

# Second plotting attempt with red:green:white and percentages, not observation counts
#scale_fill_manual(values=brewer.pal(n=6, name='RdYlGn'))

RGW6 <- brewer.pal(n=6, name='RdYlGn')
RGW6[6] <- '#FAEFEFAF'
p2 <- ggplot(lesbia.tally, aes(1, perc, fill=modes)) +
  geom_bar(data=lesbia.tally,stat="identity") +
  scale_fill_manual(values=RGW6) +
  theme(axis.title.x=element_blank(),
        axis.text.x=element_blank(),
        axis.ticks.x=element_blank(),
        axis.title.y=element_blank(),
        panel.grid.major = element_blank(),
        panel.grid.minor = element_blank(),
        panel.background = element_blank()) +
  scale_y_reverse()

plot_grid(p1, p2, ncol=2, align="v")
```


40
30
20
10
0
modes
R2
R1/R2
T
T/P
P
UNK
0
25
50
75
100
modes
R2
R1/R2
T
T/P
P
UNK

```
library(dismo)
```

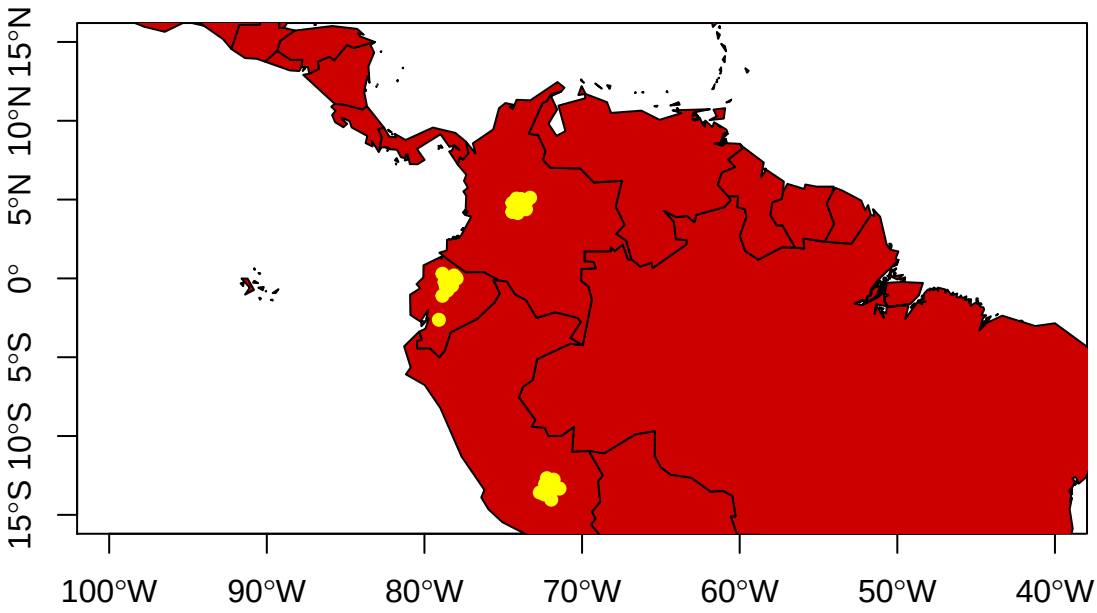
```
## Loading required package: raster
```

```
## Loading required package: sp
```

```
library(maptools)
```

```
## Checking rgeos availability: TRUE
```

```
data(wrld_simpl)
plot(wrld_simpl, xlim=c(-85,-55), ylim=c(-15,15), axes=TRUE, col="red3")
# plot points
points(jitter(lesbias$lon[complete.cases(lesbias$lon)],amount = 0.5), jitter(lesbias$lat[complete.cases
```



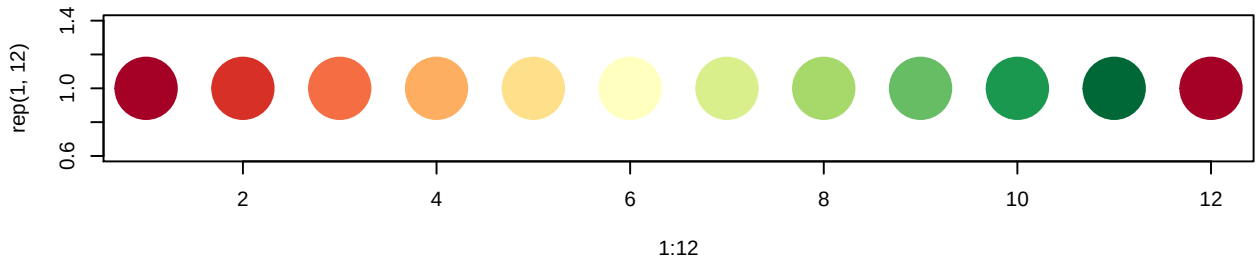

```
# plot points again to add a border, for better visibility
# points(chilense.gbif$lon, chilense.gbif$lat, col='red', cex=0.75)
```

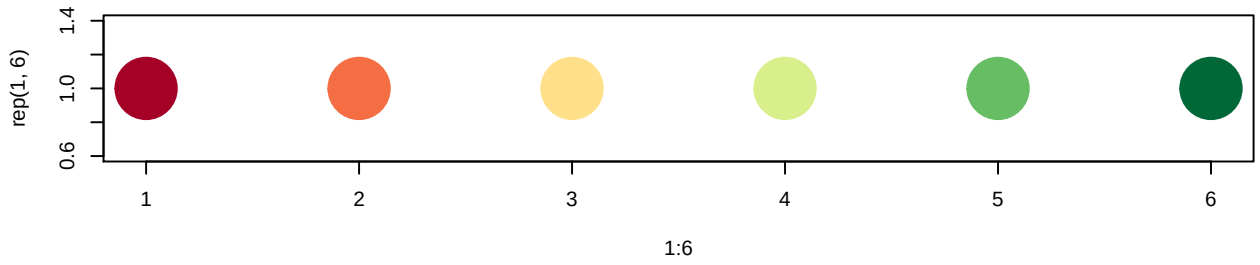
This is a color test that can be ignored, but is useful for selecting good plotting colors above.

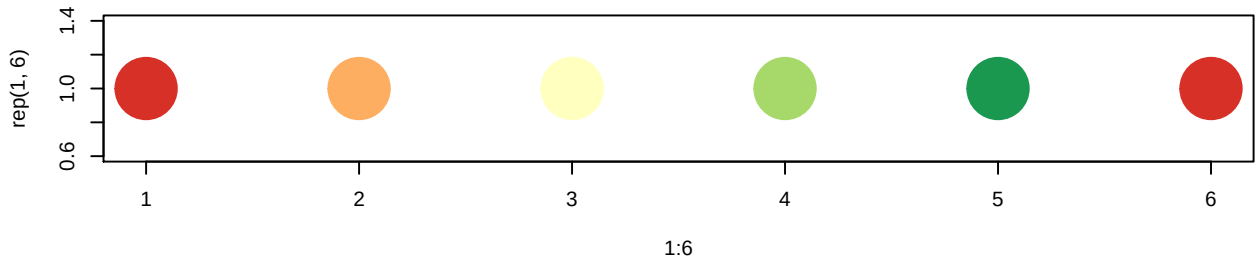
```
# brewer.pal
RGW6 <- brewer.pal(n=12, name='RdYlGn')
```

```
## Warning in brewer.pal(n = 12, name = "RdYlGn"): n too large, allowed maximum for palette RdYlGn is 1
## Returning the palette you asked for with that many colors
```

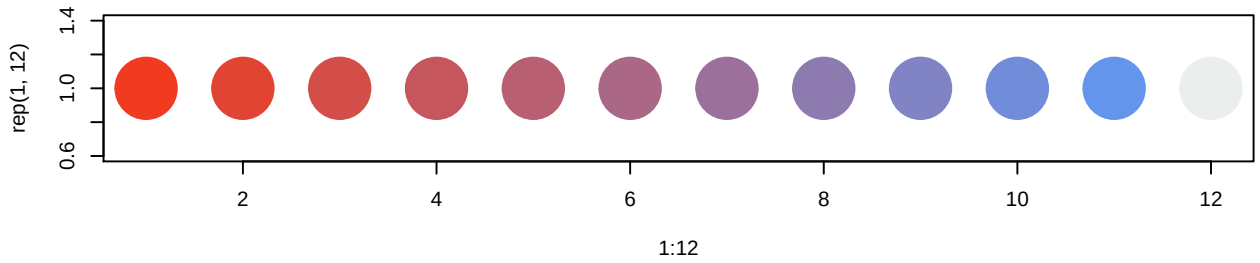
```
par(mfrow=c(3,1))
plot(1:12,rep(1,12),pch=20,cex=10,col=RGW6)
plot(1:6,rep(1,6),pch=20,cex=10,col=RGW6[c(TRUE, FALSE)])
plot(1:6,rep(1,6),pch=20,cex=10,col=RGW6[c(F,T)])
```

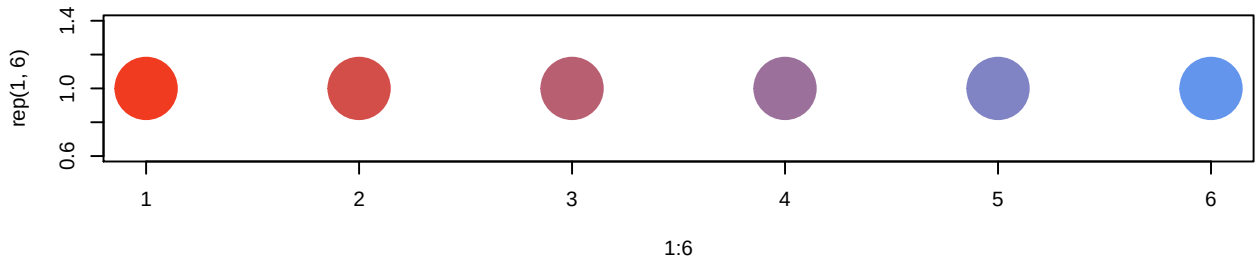


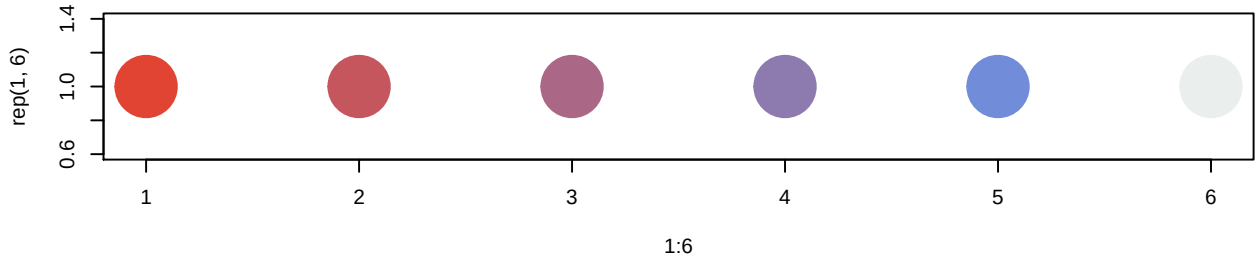




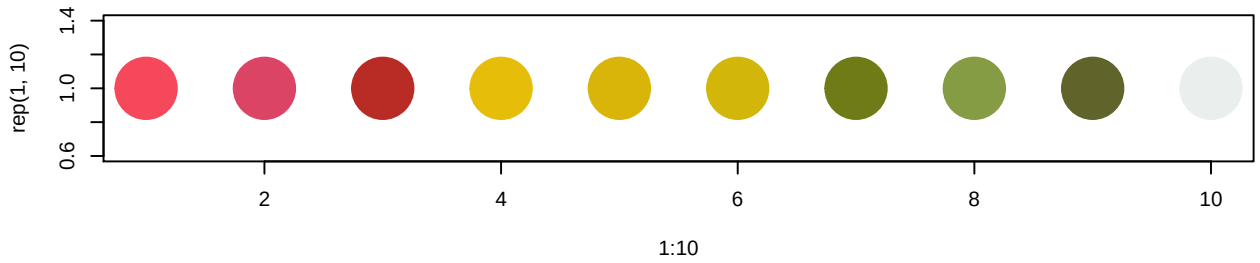

```
# rcolorbrewer
lesbia.cols <- alpha(lesbia.col(11))
RBW6 <- c(lesbia.cols,'#EAEFEDFF')
par(mfrow=c(3,1))
plot(1:12,rep(1,12),pch=20,cex=10,col=RBW6)
plot(1:6,rep(1,6),pch=20,cex=10,col=RBW6[c(TRUE, FALSE)])
plot(1:6,rep(1,6),pch=20,cex=10,col=RBW6[c(F,T)])
```

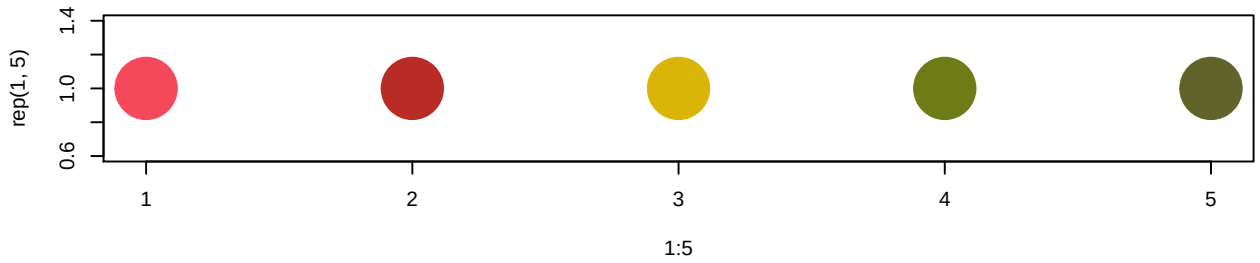


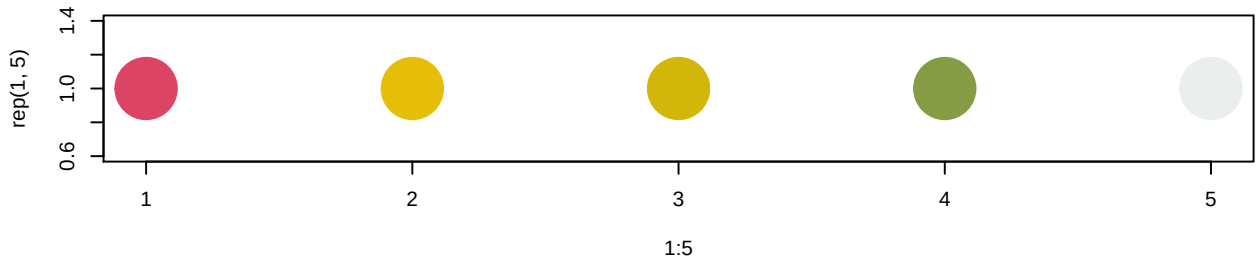





```
# manual palette
#Color picker samples from Brugmansia image:
#reds (bottom): #F5485B, #DC4465, #B92C25
#yellows: (middle): #E6BD09, #D9B509, #D2B60A
#greens (top & bird): #6F7B16,#859B44,#60642A
manual.col <- c('#F5485B', '#DC4465', '#B92C25','#E6BD09', '#D9B509', '#D2B60A','#6F7B16','#859B44','#6
manual.cols <- alpha(manual.col)
RYG6 <- c(manual.cols,'#EAEFEDFF')
par(mfrow=c(3,1))
plot(1:10,rep(1,10),pch=20,cex=10,col=RYG6)
plot(1:5,rep(1,5),pch=20,cex=10,col=RYG6[c(TRUE, FALSE)])
plot(1:5,rep(1,5),pch=20,cex=10,col=RYG6[c(F,T)])
```


rep(1, 10)
1.4
1.0
0.6
2
4
6
8
10
1:10


rep(1, 5)
1.4
1.0
0.6
1
2
3
4
5
1:5


rep(1, 5)
1.4
1.0
0.6
1
2
3
4
5
1:5