Genetic differentiation on flowering time in Cerastium fontanum using a greenhouse experiment

Logger data

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Contents

Data preparation

Read data from txt files

```
data1K<-read_delim("data/raw/Greenhouse_logger_data/1K.txt",delim=",",
                   locale=locale(encoding="latin1"))%>%
  mutate(dew_point=extract_numeric(`Dew Point(°C)`),
         serial_nr=first(`Serial Number`),record_id=`9K4`,time=Time,
         temp=`Celsius(°C)`,humidity=`Humidity(%rh)`,logger_name="1K",
         type="soil",treat="control")%>%
  dplyr::select(record_id,time,temp,humidity,dew_point,serial_nr,logger_name,
                type,treat)
data2K<-read_delim("data/raw/Greenhouse_logger_data/2K.txt",delim=",",
                   locale=locale(encoding="latin1"))%>%
  mutate(dew_point=extract_numeric(`Dew Point(°C)`),
         serial_nr=first(`Serial Number`),record_id=`9K3`,time=Time,
         temp=`Celsius(°C)`,humidity=`Humidity(%rh)`,logger_name="2K",
         type="soil",treat="control")%>%
  dplyr::select(record_id,time,temp,humidity,dew_point,serial_nr,logger_name,
                type,treat)
data3K<-read_delim("data/raw/Greenhouse_logger_data/3K.txt",delim=",",
                   locale=locale(encoding="latin1"))%>%
  mutate(dew_point=extract_numeric(`Dew Point(°C)`),
```

```
        serial_nr=first(`Serial Number`),record_id=`9K2`,time=Time,
        temp=`Celsius(°C)`,humidity=`Humidity(%rh)`,logger_name="3K",
        type="soil",treat="control")%>%
  dplyr::select(record_id,time,temp,humidity,dew_point,serial_nr,logger_name,
                type,treat)
data3K_Air_temp<-read_delim("data/raw/Greenhouse_logger_data/3K_Air_temp.txt",delim=",",
                    locale=locale(encoding="latin1"))%>%
  mutate(dew_point=extract_numeric(`Dew Point(°C)`),
        serial_nr=first(`Serial Number`),record_id=`9K1`,time=Time,
        temp=`Celsius(°C)`,humidity=`Humidity(%rh)`,logger_name="3K_Air_temp",
        type="air",treat="control")%>%
  dplyr::select(record_id,time,temp,humidity,dew_point,serial_nr,logger_name,
                type,treat)
data4V<-read_delim("data/raw/Greenhouse_logger_data/4V.txt",delim=",",
                    locale=locale(encoding="latin1"))%>%
  mutate(dew_point=extract_numeric(`Dew Point(°C)`),
        serial_nr=first(`Serial Number`),record_id=`9V4`,time=Time,
        temp=`Celsius(°C)`,humidity=`Humidity(%rh)`,logger_name="4V",
        type="soil",treat="heated")%>%
  dplyr::select(record_id,time,temp,humidity,dew_point,serial_nr,logger_name,
                type,treat)
data4V_Air_temp<-read_delim("data/raw/Greenhouse_logger_data/4V_Air_temp.txt",
                            delim=",",locale=locale(encoding="latin1"))%>%
  mutate(dew_point=extract_numeric(`Dew Point(°C)`),
        serial_nr=first(`Serial Number`),record_id=`9V3`,time=Time,
        temp=`Celsius(°C)`,humidity=`Humidity(%rh)`,logger_name="4V_Air_temp",
        type="air",treat="heated")%>%
  dplyr::select(record_id,time,temp,humidity,dew_point,serial_nr,logger_name,
                type,treat)
data5V_924readings<-read_delim("data/raw/Greenhouse_logger_data/5V_924readings.txt",
                            delim=",",locale=locale(encoding="latin1"))%>%
  mutate(dew_point=extract_numeric(`Dew Point(°C)`),
        serial_nr=first(`Serial Number`),record_id=`9V2`,time=Time,
        temp=`Celsius(°C)`,humidity=`Humidity(%rh)`,logger_name="5V_924readings",
        type="soil",treat="heated")%>%
  dplyr::select(record_id,time,temp,humidity,dew_point,serial_nr,logger_name,
                type,treat)
data6V<-read_delim("data/raw/Greenhouse_logger_data/6V.txt",delim=",",
                    locale=locale(encoding="latin1"))%>%
  mutate(dew_point=extract_numeric(`Dew Point(°C)`),
        serial_nr=first(`Serial Number`),record_id=`9V1`,time=Time,
        temp=`Celsius(°C)`,humidity=`Humidity(%rh)`,logger_name="6V",
        type="soil",treat="heated")%>%
  dplyr::select(record_id,time,temp,humidity,dew_point,serial_nr,logger_name,
                type,treat)
data7V<-read_delim("data/raw/Greenhouse_logger_data/7V.txt",delim=",",
                    locale=locale(encoding="latin1"))%>%
  mutate(dew_point=extract_numeric(`Dew Point(°C)`),
        serial_nr=first(`Serial Number`),record_id=`10V4`,time=Time,
        temp=`Celsius(°C)`,humidity=`Humidity(%rh)`,logger_name="7V",
        type="soil",treat="heated")%>%
  dplyr::select(record_id,time,temp,humidity,dew_point,serial_nr,logger_name,
                type,treat)
```

```
data8V<-read_delim("data/raw/Greenhouse_logger_data/8V.txt",delim=",",
                   locale=locale(encoding="latin1"))%>%
  mutate(dew_point=extract_numeric(`Dew Point(°C)`),
         serial_nr=first(`Serial Number`),record_id=`10V3`,time=Time,
         temp=`Celsius(°C)`,humidity=`Humidity(%rh)`,logger_name="8V",
         type="soil",treat="heated")%>%
  dplyr::select(record_id,time,temp,humidity,dew_point,serial_nr,logger_name,
                type,treat)
data8V_Air_temp<-read_delim("data/raw/Greenhouse_logger_data/8V_Air_temp.txt",delim=",",
                   locale=locale(encoding="latin1"))%>%
  mutate(dew_point=extract_numeric(`Dew Point(°C)`),
         serial_nr=first(`Serial Number`),record_id=`10V2`,time=Time,
         temp=`Celsius(°C)`,humidity=`Humidity(%rh)`,logger_name="8V_Air_temp",
         type="air",treat="heated")%>%
  dplyr::select(record_id,time,temp,humidity,dew_point,serial_nr,logger_name,
                type,treat)
data9V<-read_delim("data/raw/Greenhouse_logger_data/9V.txt",delim=",",
                   locale=locale(encoding="latin1"))%>%
  mutate(dew_point=extract_numeric(`Dew Point(°C)`),
         serial_nr=first(`Serial Number`),record_id=`10V1`,time=Time,
         temp=`Celsius(°C)`,humidity=`Humidity(%rh)`,logger_name="9V",
         type="soil",treat="heated")%>%
  dplyr::select(record_id,time,temp,humidity,dew_point,serial_nr,logger_name,
                type,treat)
data10K<-read_delim("data/raw/Greenhouse_logger_data/10K.txt",delim=",",
                   locale=locale(encoding="latin1"))%>%
  mutate(dew_point=extract_numeric(`Dew Point(°C)`),
         serial_nr=first(`Serial Number`),record_id=`10K4`,time=Time,
         temp=`Celsius(°C)`,humidity=`Humidity(%rh)`,logger_name="10K",
         type="soil",treat="control")%>%
  dplyr::select(record_id,time,temp,humidity,dew_point,serial_nr,logger_name,
                type,treat)
data11K<-read_delim("data/raw/Greenhouse_logger_data/11K.txt",delim=",",
                   locale=locale(encoding="latin1"))%>%
  mutate(dew_point=extract_numeric(`Dew Point(°C)`),
         serial_nr=first(`Serial Number`),record_id=`10K2`,time=Time,
         temp=`Celsius(°C)`,humidity=`Humidity(%rh)`,logger_name="11K",
         type="soil",treat="control")%>%
  dplyr::select(record_id,time,temp,humidity,dew_point,serial_nr,logger_name,
                type,treat)
data11K_Air_temp<-read_delim("data/raw/Greenhouse_logger_data/11K_Air_temp.txt",
                             delim=",",locale=locale(encoding="latin1"))%>%
  mutate(dew_point=extract_numeric(`Dew Point(°C)`),
         serial_nr=first(`Serial Number`),record_id=`10K3`,time=Time,
         temp=`Celsius(°C)`,humidity=`Humidity(%rh)`,logger_name="11K_Air_temp",
         type="air",treat="control")%>%
  dplyr::select(record_id,time,temp,humidity,dew_point,serial_nr,logger_name,
                type,treat)
data12K<-read_delim("data/raw/Greenhouse_logger_data/12K.txt",delim=",",
                   locale=locale(encoding="latin1"))%>%
  mutate(dew_point=extract_numeric(`Dew Point(°C)`),
         serial_nr=first(`Serial Number`),record_id=`10K1`,time=Time,
         temp=`Celsius(°C)`,humidity=`Humidity(%rh)`,logger_name="12K",
```

```
        type="soil",treat="control")%>%
  dplyr::select(record_id,time,temp,humidity,dew_point,serial_nr,logger_name,
                type,treat)
```

Merge all logger data

```
data_loggers<-rbind(data1K,data2K,data3K,data3K_Air_temp,data4V,data4V_Air_temp,
                    data5V_924readings,data6V,data7V,data8V,data8V_Air_temp,
                    data9V,data10K,data11K,data11K_Air_temp,data12K)%>%
  mutate(serial_nr=as.factor(serial_nr),logger_name=as.factor(logger_name),
         type=as.factor(type))
```

Calculations

```
data_loggers%>%filter(time<"2022-06-16")%>%
  group_by(logger_name,treat)%>%summarise(mean_temp=mean(temp))
```

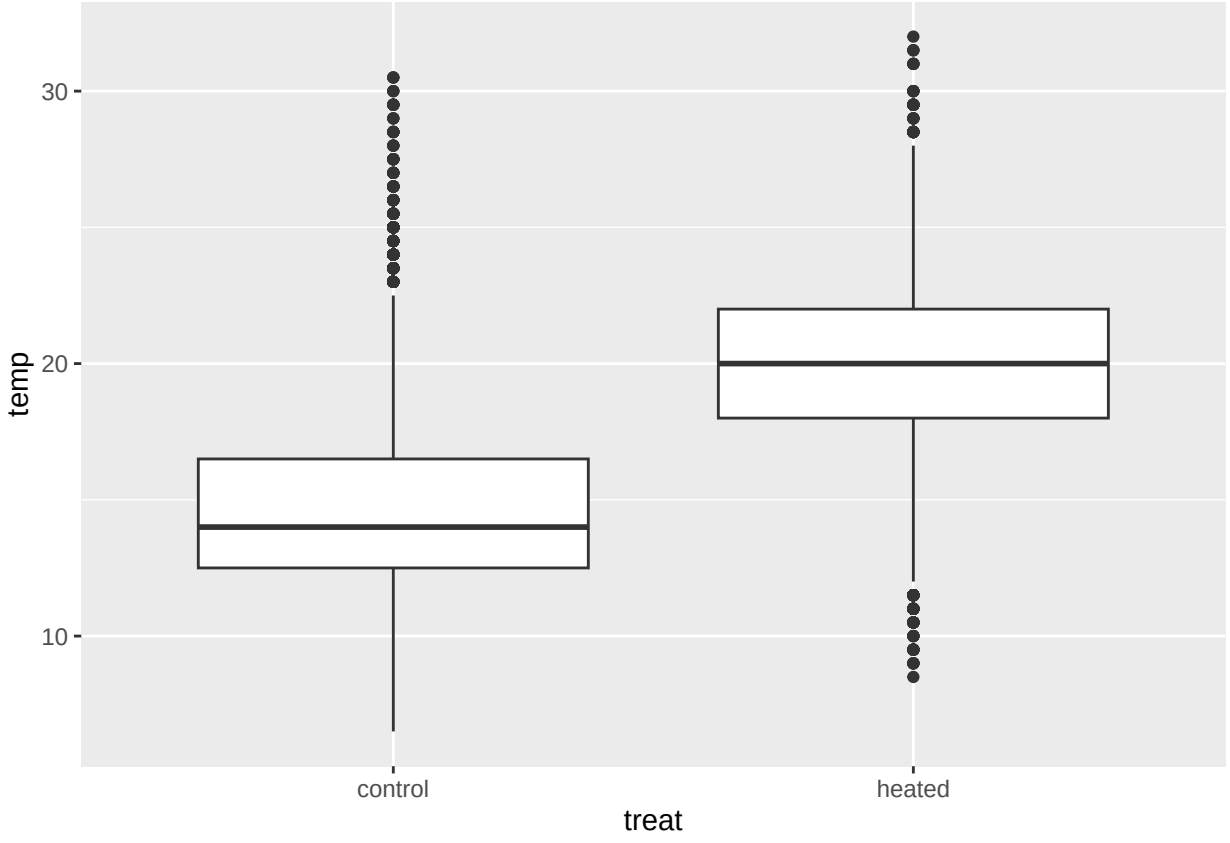
```
## # A tibble: 16 x 3
## # Groups:   logger_name [16]
##    logger_name    treat   mean_temp
##    <fct>          <chr>       <dbl>
##  1 10K            control      14.6
##  2 11K            control      14.3
##  3 11K_Air_temp   control      15.5
##  4 12K            control      14.2
##  5 1K             control      14.1
##  6 2K             control      14.8
##  7 3K             control      14.3
##  8 3K_Air_temp    control      15.0
##  9 4V             heated       20.4
## 10 4V_Air_temp    heated       17.4
## 11 5V_924readings heated       19.8
## 12 6V             heated       21.3
## 13 7V             heated       20.9
## 14 8V             heated       20.5
## 15 8V_Air_temp    heated       18.2
## 16 9V             heated       21.5
```

```
data_loggers%>%filter(time<"2022-06-16")%>%group_by(logger_name,treat)%>%
  summarise(min_temp=min(temp),max_temp=max(temp))%>%
  mutate(range_temp=max_temp-min_temp)
```

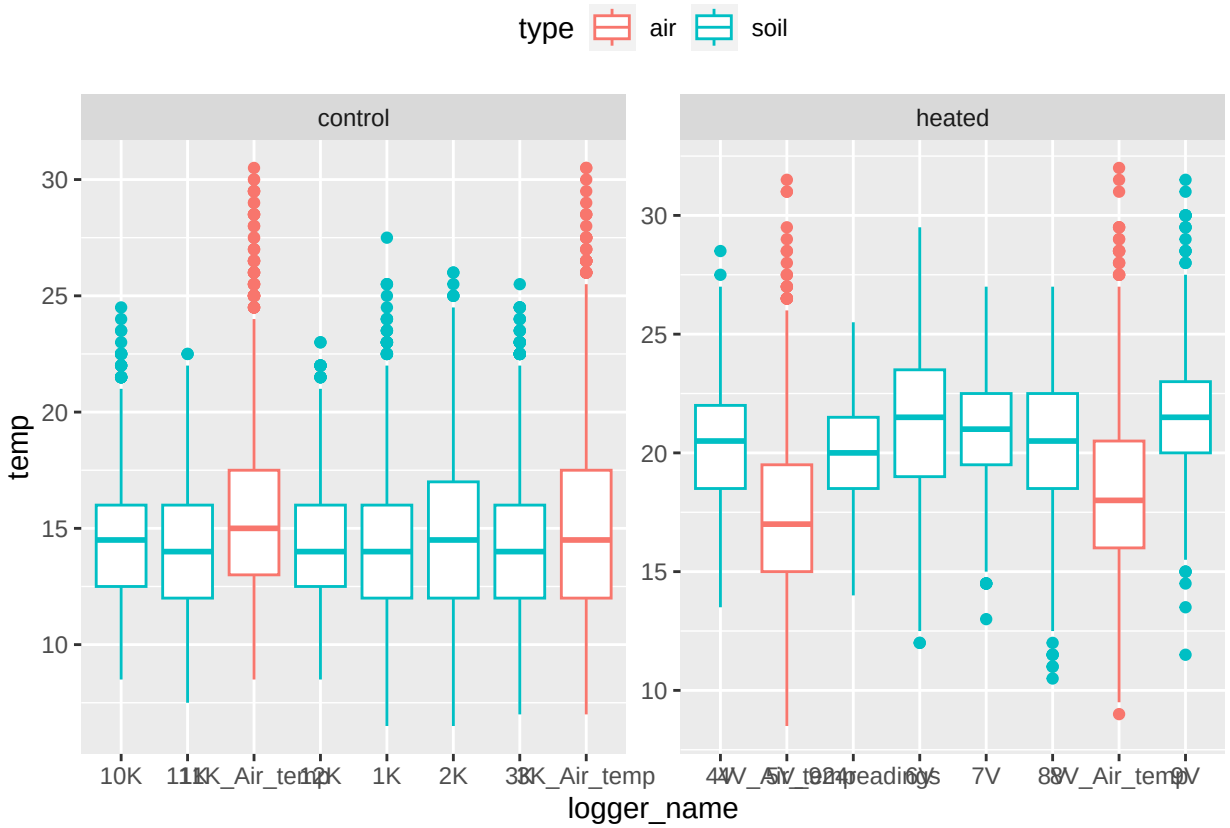
```
## # A tibble: 16 x 5
## # Groups:   logger_name [16]
##    logger_name    treat   min_temp max_temp range_temp
##    <fct>          <chr>      <dbl>    <dbl>      <dbl>
##  1 10K            control      8.5     24.5       16
```

```
##  2 11K            control      7.5     22.5       15
##  3 11K_Air_temp   control      8.5     30.5       22
##  4 12K            control      8.5     23         14.5
##  5 1K             control      6.5     27.5       21
##  6 2K             control      6.5     26         19.5
##  7 3K             control      7       25.5       18.5
##  8 3K_Air_temp    control      7       30.5       23.5
##  9 4V             heated      13.5     28.5       15
## 10 4V_Air_temp    heated       8.5     31.5       23
## 11 5V_924readings heated      14       25.5       11.5
## 12 6V             heated      12       29.5       17.5
## 13 7V             heated      13       27         14
## 14 8V             heated      10.5     27         16.5
## 15 8V_Air_temp    heated       9       32         23
## 16 9V             heated      11.5     31.5       20
```

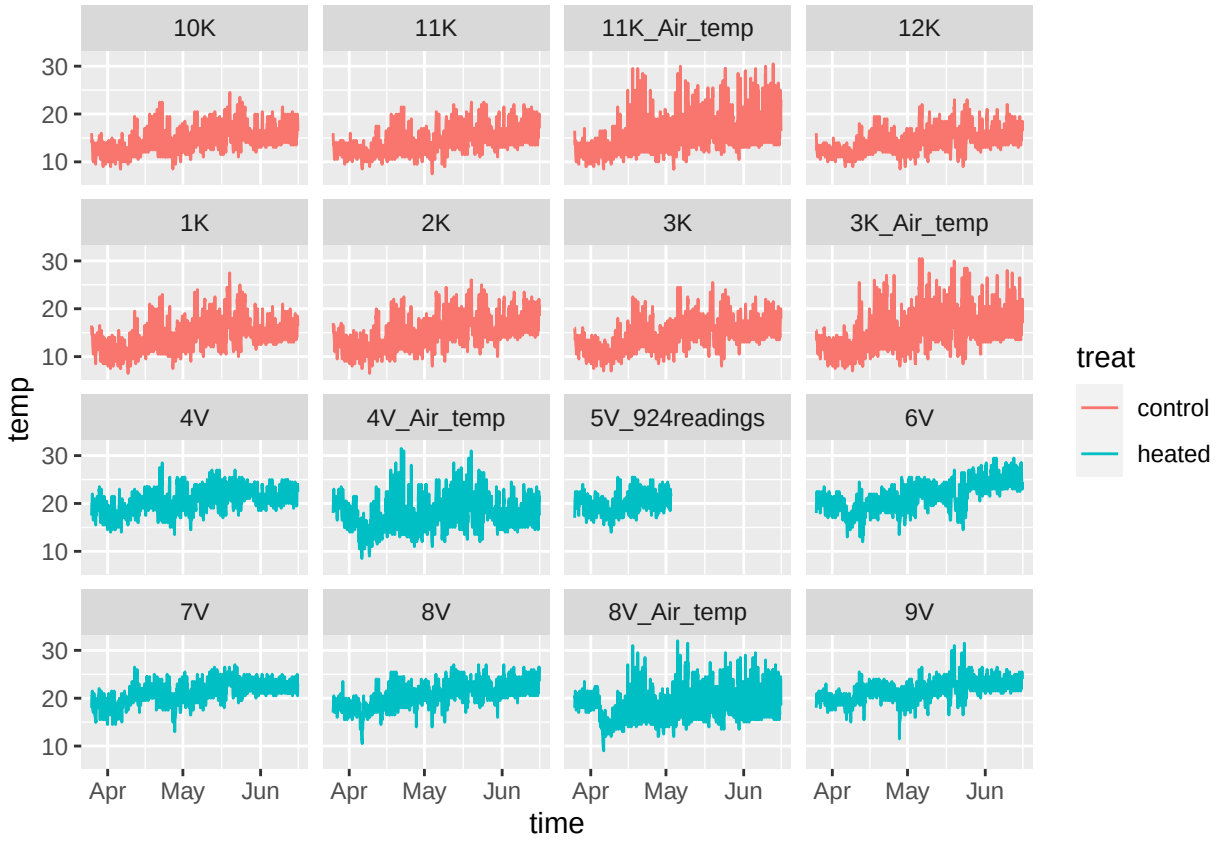
```
ggplot(data_loggers%>%filter(time<"2022-06-16"),aes(x=treat,y=temp))+
  geom_boxplot()
```




```
ggplot(data_loggers%>%filter(time<"2022-06-16"),
       aes(x=logger_name,y=temp,color=type))+
  facet_wrap(~treat,scales="free")+
  geom_boxplot()+theme(legend.position="top")
```




```
ggplot(data_loggers%>%filter(time<"2022-06-16"),
       aes(x=time,y=temp,color=treat,shape=type))+geom_line()+
  facet_wrap(~logger_name)
```



Session info

```
sessionInfo()
```

```
## R version 4.3.1 (2023-06-16 ucrt)
## Platform: x86_64-w64-mingw32/x64 (64-bit)
## Running under: Windows 11 x64 (build 22621)
##
## Matrix products: default
##
##
## locale:
## [1] LC_COLLATE=English_United States.utf8
## [2] LC_CTYPE=English_United States.utf8
## [3] LC_MONETARY=English_United States.utf8
## [4] LC_NUMERIC=C
## [5] LC_TIME=English_United States.utf8
##
## time zone: Europe/Madrid
## tzcode source: internal
##
## attached base packages:
## [1] stats     graphics  grDevices utils     datasets  methods   base
```

```
##
## other attached packages:
##  [1] RColorBrewer_1.1-3 lubridate_1.9.2    forcats_1.0.0      stringr_1.5.0
##  [5] dplyr_1.1.3        purrr_1.0.2        readr_2.1.4        tidyr_1.3.0
##  [9] tibble_3.2.1       ggplot2_3.4.3      tidyverse_2.0.0
##
## loaded via a namespace (and not attached):
##  [1] bit_4.0.5         gtable_0.3.4      crayon_1.5.2      compiler_4.3.1
##  [5] tidyselect_1.2.0  parallel_4.3.1    scales_1.2.1      yaml_2.3.7
##  [9] fastmap_1.1.1     R6_2.5.1          labeling_0.4.3    generics_0.1.3
## [13] knitr_1.44        munsell_0.5.0     pillar_1.9.0      tzdb_0.4.0
## [17] rlang_1.1.1       utf8_1.2.3        stringi_1.7.12    xfun_0.40
## [21] bit64_4.0.5       timechange_0.2.0  cli_3.6.1         withr_2.5.0
## [25] magrittr_2.0.3    digest_0.6.33     grid_4.3.1        vroom_1.6.3
## [29] rstudioapi_0.15.0 hms_1.1.3         lifecycle_1.0.3   vctrs_0.6.3
## [33] evaluate_0.21     glue_1.6.2        farver_2.1.1      fansi_1.0.4
## [37] colorspace_2.1-0  rmarkdown_2.25    tools_4.3.1       pkgconfig_2.0.3
## [41] htmltools_0.5.6
```