#=========================2024.05.28=======B1===================

library(showtext) # 加载包

#serif代表Times New Roman字体，sans代表Arial字体，mono代表Courier New字体。这种映射关系在基础绘图系统和ggplot2系统中均可使用。

library(sysfonts) # 加载

library(vegan)

library(readxl)

library(ggplot2)

library(openxlsx)

library(ggpubr)

# 读取Excel文件

data <- read\_excel("OTU-MPs.xlsx", sheet = "NMDS")

# 提取分组因子列

groups <- data$Treatment

# 提取数值型数据列#

nmds\_data <- as.matrix(data[, -(1:2)])

dist\_matrix <- vegdist(nmds\_data, method = "bray")

# 进行NMDS分析

nmds <- metaMDS(dist\_matrix, k = 2)

# 计算stress值

stress\_value <- nmds$stress

# 输出stress值

print(paste("Stress value:", stress\_value))

# 进行ANOSIM分析

anosim\_result <- anosim(dist\_matrix, groups, permutations = 999)

summary(anosim\_result)

# 提取NMDS坐标

nmds\_coordinates <- scores(nmds, display = "sites", choices = c(1, 2))

# 创建包含分组因子的数据框

nmds\_df <- data.frame(nmds\_coordinates, groups)

merged\_data <- cbind(data[, 1:2], nmds\_coordinates)

#write.xlsx(merged\_data,file = "nmds.xlsx")

nmds\_df$groups <- factor(nmds\_df$groups, levels = c("Control", "PP", "PLA"))

# 绘制NMDS图形

p1 <- plot <- ggplot(nmds\_df, aes(x = NMDS1, y = NMDS2, color = groups)) +

geom\_vline(xintercept = 0, linetype = "dashed", color = "black", alpha = 0.8) +

geom\_hline(yintercept = 0, linetype = "dashed", color = "black", alpha = 0.8) +

geom\_point(shape = 16, size = 3.5, stroke = 1) +

#stat\_ellipse(aes(fill = groups), geom = 'polygon', level = 0.95, alpha = 0.1, show.legend = FALSE) +

stat\_chull(aes(color = groups,fill = groups), geom = "polygon",size=0.7, alpha = 0.1, show.legend = FALSE)+

labs(x = "NMDS1", y = "NMDS2", color = "Treatment") +

theme\_minimal() +

scale\_x\_continuous(labels = scales::number\_format(accuracy = 0.1)) +

scale\_y\_continuous(labels = scales::number\_format(accuracy = 0.1)) +

scale\_color\_manual(values = c("#EECA40", "#FD7541", "#23B9C7")) +

scale\_fill\_manual(values = c("#EECA40", "#FD7541", "#23B9C7")) +

theme(panel.border = element\_rect(color = "black", fill = NA, size = 1),

axis.ticks.x = element\_line(color = "black"),

axis.ticks.y = element\_line(color = "black"),

axis.ticks.length = unit(0.15, "cm"),

axis.text.x = element\_text(face = "bold", color = "black", size = rel(1.7)),

axis.text.y = element\_text(face = "bold", color = "black", size = rel(1.7)),

axis.title = element\_text(face = "bold", size = rel(1.5)),

legend.title = element\_text(face = "bold", size = rel(1.5)),

legend.text = element\_text(face = "bold", size = rel(1.5)),

plot.margin = margin(10, 10, 10, 10),

text = element\_text(family = "serif", size = 14)) +#serif代表Times New Roman字体，sans代表Arial字体，mono代表Courier New字体

coord\_cartesian(xlim = c(-0.35, 0.35), ylim = c(-0.35, 0.35))+

annotate("text", x =0.2, y = -0.2, label="Stress = 0.07", cex = 5, col = "black", fontface = 2,family = "serif")+

annotate("text", x =0.2, y = -0.25, label="P < 0.05", cex = 5, col = "black", fontface = 2,family = "serif")+

annotate("text", x =0.2, y = -0.3, label="Anosim R = 0.18", cex = 5, col = "black", fontface = 2,family = "serif")

p1

# 保存图形（不包括图例）

#ggsave("0715.tiff", plot, width = 6, height = 4.75, dpi = 300, units = "in", device = "tiff")

#=================================导出图形===============================

ggsave("nmsd.pdf", p1, width = 6.5, height = 4.75, dpi = 300)