viruses and fungi, and from reduced growth and vigor due to abiotic stress. In various aspects, the disclosure pertains to methods comprising using a bioprotectant composition comprising a cell-free supernatant derived from a microbial fermentation culture inoculated with a mixture of microorganisms.

Disclosed are methods for bioprotection comprising providing a bioprotectant composition comprising cell-free supernatant derived from a microbial fermentation culture inoculated with one or more isolated microorganism, wherein the microorganism comprises *Aspergillus* spp., for example, *Apergillus oryzae,* IN-AO1, deposited September 4, 2014 with ATCC, PTA-121551; *Bacillus* spp., for example, *Bacillus subtilis,* IN-BSI, deposited January 11, 2012 with ATCC, PTA-12385; *Rhodopseudomonas* spp., for example, *Rhodopseudomonas palustris,* IN-RPI, deposited January 11, 2012 with ATCC, PTA-12387; *Rhodopseudomonas palustris,* IN-RP2, deposited September 4, 2014 with ATCC, PTA-121533; *Candida* spp., for example, *Candida utilis,* IN-CUl, deposited September 4, 2014 with ATCC, PTA-12550; *Lactobacillus* spp., for example, *Lactobacillus helveticus,* IN-LHI, deposited January 11, 2012, with ATCC, PTA 12386; *Lactobacillus rhamnosus,* IN-LR1, deposited September 4, 2014 with ATCC, PTA 121554; *Lactobacillus casei,* IN-LC1, deposited September 4, 2014 with ATCC, PTA-121549; *Lactobacillus plantarum,* IN-LP1, deposited September 4, 2014 with ATCC, PTA 121555; *Lactococcus* spp., for example, *Lactococcus lactis,* IN-LL1, deposited September 4, 2014 with ATCC, PTA-121552; *Pseudomonas* spp., for example, *Pseudomonas aeuroginosa* or *Pseudomonas fluorescens; Saccharomyces* spp., for example, *Saccharomyces cerevisiae,* IN-SCI, deposited on January 11, 2012 with ATCC, PTA-12384; or *Streptococcus* spp., for example, Streptococcus lactis; or combinations thereof, or a microbial consortia comprising one or more of the above, for example, IN-M1, deposited January 11, 2012 with ATCC, PTA-12383 and/or IN-M2, deposited September 4, 2014 with ATCC, PTA-121556, to a plant seed, to a plant fruit, to a plant, or to a plant at a particular growth stage, or combinations thereof, or to the soil or a plant growth media in which a plant, seed or plant part can be planted or grown, thereby providing bioprotection to the plant, seed, fruit or other plant parts.

In one aspect, there is provided a method for reducing plant pathological damage due to a fungal or bacterial plant pathogen comprising,

contacting a plant, plant part, seed, soil or a plant growth media with a bioprotectant composition comprising a cell-free supernatant of a microbial fermentation culture inoculated with IN-M1, deposited under ATCC Accession No. PTA-12383, or IN-M2, deposited under ATCC Accession No. PTA-121556, wherein a plant grown from the plant, plant part, seed, soil or a plant growth media contacted with the bioprotectant composition has reduced pathological damage compared to an untreated control plant grown under the same conditions.

In one aspect, there is provided a method for reducing abiotic stress of a plant, the abiotic stress resulting in reduced growth and/or yield due to an environmental condition, comprising,

contacting a plant, plant part, seed, soil or a plant growth media with a bioprotectant composition comprising a cell-free supernatant of a microbial fermentation culture inoculated with IN-M1, deposited under ATCC Accession No. PTA-12383, or IN-M2, deposited under ATCC Accession No. PTA-121556, wherein the pH of the bioprotectant composition has a pH from 5.0 to 7.0 and wherein a plant grown from the plant, plant part, seed, soil or a plant growth media treated with the bioprotectant composition has reduced abiotic stress compared to an untreated control plant grown under the same conditions.

BRIEF DESCRIPTION OF THE FIGURES

The accompanying figures, which are incorporated in and constitute a part of this specification, illustrate several aspects and together with the description serve to explain the principles of the invention.

FIG. 1A and 1B show representative data pertaining to the effect of various dilutions of a cell-free supernatant derived from a microbial fermentation culture of IN-M1 deposited

CLAIMS

What is claimed is:

1. A method for reducing plant pathological damage due to a fungal or bacterial plant pathogen comprising,

contacting a plant, plant part, seed, soil or a plant growth media with a bioprotectant composition comprising a cell-free supernatant of a microbial fermentation culture inoculated with IN-M1, deposited under ATCC Accession No. PTA-12383, or IN-M2, deposited under ATCC Accession No. PTA-121556, wherein a plant grown from the plant, plant part, seed, soil or a plant growth media contacted with the bioprotectant composition has reduced pathological damage compared to an untreated control plant grown under the same conditions.

2. The method of claim 1, wherein the bioprotectant composition further comprises an herbicide, a pesticide, a nematocide, a fungicide, a fertilizer, or a nutrient component, or combinations thereof.

3. The method of any one of claims 1 or 2, wherein the microbial culture comprises humic acid, potato starch, or molasses.

4. The method of any one of claims 1-3, wherein the bioprotectant composition further comprises a wetting agent, a gelling agent, a higher fatty acid, 3-hydroxydecanoic acid, 3-hydroxydodecanoic acid, 3-hydroxytetradecanoic acid, 3-hydroxy-5-cis-dodecenoic acid, a volatile fatty acid, acetic acid, butyric acid, isobutyric acid, propionic acid, or combinations thereof.

5. The method of any one of claims 1-4, wherein the pH of the bioprotectant composition is from pH 5.0 to 7.0.

6. The method of any one of claims 1-5, wherein the plant is rice, wheat, corn, tomato, banana, coffee, soybean, potato, a citrus, orange, grapefruit, lemon, lime, cucumber, cauliflower, or strawberry, a vegetable plant, an ornamental plant or an ornamental tree.

7. The method of any of claims 1-6, wherein contacting with the bioprotectant composition comprises contacting plant parts, seeds, roots, shoots, tubers, leaves or stalks of plants.

8. The method of any of claims 1-6, wherein contacting with the bioprotectant composition comprises contacting soil or growth media of plants.

9. The method of any of claims 1-6, wherein the plant is grown under hydroponic conditions, aeroponic conditions or combined aeroponic and hydroponic conditions.

10. The method of any of claims 1-8, wherein the plant is grown in a greenhouse or in a field.

11. The method of any of claims 1-7, wherein contacting with the bioprotectant compositions comprises contacting seeds and the seeds are contacted with the bioprotectant composition prior to planting the seeds or prior to storage of the seeds.

12. The method of any of claims 1-10, wherein the plant is contacted with the bioprotectant composition during transplantation of the plant, during the plant's vegetative stage, at the plant's flowering stage, at the plant's reproductive stage, or combinations thereof.

13. The method of any of claims 1-10, wherein the plant is contacted with the bioprotectant composition following contact by a microbial plant pathogen.

14. The method of any of claims 1-10, wherein the plant is contacted with the bioprotectant composition following contact by a nematode.

15. The method of any of claims 1-10, wherein the plant is contacted with the bioprotectant composition before contact by a microbial plant pathogen.

16. The method of any of claims 1-10, wherein the plant is contacted with the bioprotectant composition before contact by a nematode.

17. The method of any of claims 1-16, wherein the plant, plant part, seed, soil or a plant growth media is contacted with the bioprotectant composition by providing the bioprotectant composition admixed with irrigation water and spraying the bioprotectant composition onto the plant, plant part, seed, soil or a plant growth media.

18. The method of any of claims 1-17, wherein the plant, plant part, seed, soil or a plant growth media is contacted by an article comprising the bioprotectant composition.

19. The method of claim 18, wherein the article is a biochar, a bead, a filter, a container, a nanoparticle, a microparticle, a mat, a screen, a powder, a particulate, or a cloth.

20. The method of claim 18, wherein the article comprises a woven material, a non-woven material, a plant material, a mat, a container, a polymeric material, a porous material, a non-porous material, or a zeolite.

21. A method for reducing abiotic stress of a plant, the abiotic stress resulting in reduced growth and/or yield due to an environmental condition, comprising,

contacting a plant, plant part, seed, soil or a plant growth media with a bioprotectant composition comprising a cell-free supernatant of a microbial fermentation culture inoculated with IN-M1, deposited under ATCC Accession No. PTA-12383, or IN-M2, deposited under ATCC Accession No. PTA-121556, wherein the pH of the bioprotectant composition has a pH from 5.0 to 7.0 and wherein a plant grown from the plant, plant part, seed, soil or a plant growth media treated with the bioprotectant composition has reduced abiotic stress compared to an untreated control plant grown under the same conditions.

22. The method of claim 21, wherein the bioprotectant composition further comprises an herbicide, a pesticide, a nematocide, a fungicide, a fertilizer, or a nutrient component, or combinations thereof.

23. The method of any one of claims 21 or 22, wherein the microbial culture comprises humic acid, potato starch, or molasses.

24. The method of any one of claims 21-23, wherein the bioprotectant composition further comprises a wetting agent, a gelling agent, a higher fatty acid, 3-hydroxydecanoic acid, 3-hydroxydodecanoic acid, 3-hydroxytetradecanoic acid, 3-hydroxy-5-cis-dodecenoic acid, a volatile fatty acid, acetic acid, butyric acid, isobutyric acid, propionic acid, or combinations thereof.

25. The method of claim 21, wherein the environmental stress is overwatering.

26. The method of any one of claims 21-25, wherein the plant is a monocot or a dicot, rice, wheat, maize, wheat, rice, barley, sorghum, or rye, soybean, , Brassica, sunflower, cotton, alfalfa, cotton, tomato, banana, coffee, , potato, a citrus, orange, grapefruit, lemon, lime, cucumber, cauliflower, or strawberry, a vegetable plant, an ornamental plant or an ornamental tree.

27. The method of any of claims 21-26, wherein contacting with the bioprotectant composition comprises contacting plant parts, seeds, roots, shoots, tubers, leaves or stalks of plants.

28. The method of any of claims 1-26, wherein contacting with the bioprotectant composition comprises contacting soil or growth media of plants.

29. The method of any of claims 21-27, wherein the plant is grown under hydroponic conditions, aeroponic conditions or combined aeroponic and hydroponic conditions.

30. The method of any of claims 21-28, wherein the plant is grown in a greenhouse or in a field.

31. The method of any of claims 21-27, wherein contacting with the bioprotectant composition comprises contacting seeds and the seeds are contacted with the bioprotectant composition prior to planting the seeds or prior to storage of the seeds.

32. The method of any of claims 21-30, wherein the plant is contacted with the bioprotectant composition during transplantation of the plant, during the plant's vegetative stage, at the plant's flowering stage, or at the plant's reproductive stage, or combinations thereof.

33. The method of any of claims 21-30, wherein the plant is contacted with the bioprotectant composition following contact by a microbial plant pathogen.

34. The method of any of claims 21-30, wherein the plant is contacted with the bioprotectant composition following contact by a nematode.

35. The method of any of claims 21-30, wherein the plant is contacted with the bioprotectant composition before contact by a microbial plant pathogen.

36. The method of any of claims 21-30, wherein the plant is contacted with the bioprotectant composition before contact by a nematode.

37. The method of any of claims 21-36, wherein the plant, plant part, seed, soil or a plant growth media is contacted with the bioprotectant composition by providing the bioprotectant composition admixed with irrigation water and spraying the bioprotectant composition onto the plant, plant part, seed, soil or a plant growth media.

38. The method of any of claims 21-37, wherein the plant, plant part, seed, soil or a plant growth media is contacted by an article comprising the bioprotectant composition.

39. The method of claim 38, wherein the article is a biochar, a bead, a filter, a container, a nanoparticle, a microparticle, a mat, a screen, a powder, a particulate, or a cloth.

40. The method of claim 38, wherein the article comprises a woven material, a non-woven material, a plant material, a mat, a container, a polymeric material, a porous material, a non-porous material, or a zeolite.