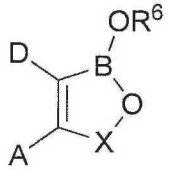
We claim:

1. A method of using a volatile antimicrobial compound against pathogens affecting meats, plants, or plant parts, comprising providing in gaseous form a volatile antimicrobial compound of formula (IV):



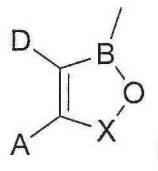
(IV)

wherein A and D together with the carbon atoms to which they are attached form a 5-, 6-, or 7-membered fused ring which may be substituted by C_1-C_6 -alkyl, C_1-C_6 -alkoxy, hydroxy, halogen, nitro, nitrile, amino, amino substituted by one or more C_1-C_6 -alkyl groups, carboxy, acyl, aryloxy, carbonamido, carbonamido substituted by C_1-C_6 -alkyl, sulfonamido or trifluoromethyl or the fused ring may link two oxaborole rings;

X is a group $-CR^7R^8$ wherein R^7 and R^8 are each independently hydrogen, C_1-C_6 -alkyl, nitrile, nitro, aryl, arylalkyl or R^7 and R^8 together with the carbon atom to which they are attached form an alicyclic ring; and

R^6 is hydrogen, C_1-C_{18} -alkyl, C_1-C_{18} -alkyl substituted by C_1-C_6 -alkoxy, C_1-C_6 -alkylthio, hydroxy, amino, amino substituted by C_1-C_{18} -alkyl, carboxy, aryl, aryloxy, carbonamido, carbonamido substituted by C_1-C_6 -alkyl, aryl or arylalkyl, arylalkyl, aryl, heteroaryl, cycloalkyl, C_1-C_{18} -alkyleneamino, C_1-C_{18} -alkyleneamino substituted by phenyl, C_1-C_6 -alkoxy or C_1-C_6 -alkylthio, carbonyl alkyleneamino or a radical of

formula (V):



(V)

wherein A, D and X are as defined herein before except for boronophthalide;

and agriculturally acceptable salts thereof;

and contacting a meat, plant, or plant part with an effective amount of the volatile antimicrobial compound in gaseous form.

2. The method of claim 1, wherein the pathogen is selected from the group consisting of *Acremonium* spp., *Albugo* spp., *Alternaria* spp., *Ascochyta* spp., *Aspergillus* spp., *Botryodiplodia* spp., *Botryospheria* spp., *Botrytis* spp., *Byssochlamys* spp., *Candida* spp.,

Cephalosporium spp., *Ceratocystis* spp., *Cercospora* spp., *Chalara* spp., *Cladosporium* spp., *Colletotrichum* spp., *Cryptosporiopsis* spp., *Cylindrocarpon* spp., *Debaryomyces* spp., *Diaporthe* spp., *Didymella* spp., *Diplodia* spp., *Dothiorella* spp., *Elsinoe* spp., *Fusarium* spp., *Geotrichum* spp., *Gloeosporium* spp., *Glomerella* spp., *Helminthosporium* spp., *Khuskia* spp., *Lasiodiplodia* spp., *Macrophoma* spp., *Macrophomina* spp., *Microdochium* spp., *Monilinia* spp., *Monilochaethes* spp., *Mucor* spp., *Mycocentrospora* spp., *Mycosphaerella* spp., *Nectria* spp., *Neofabraea* spp., *Nigrospora* spp., *Penicillium* spp., *Peronophythora* spp., *Peronospora* spp., *Pestalotiopsis* spp., *Pezicula* spp., *Phacidiopycnis* spp., *Phoma* spp., *Phomopsis* spp., *Phyllosticta* spp., *Phytophthora* spp., *Polyscytalum* spp., *Pseudocercospora* spp., *Pyricularia* spp., *Pythium* spp., *Rhizoctonia* spp., *Rhizopus* spp., *Sclerotium* spp., *Sclerotinia* spp., *Septoria* spp., *Sphaceloma* spp., *Sphaeropsis* spp., *Stemphyllium* spp., *Stilbella* spp., *Thielaviopsis* spp., *Thyronectria* spp., *Trachysphaera* spp., *Uromyces* spp., *Ustilago* spp., *Venturia* spp., and *Verticillium* spp.

3. The method of claim 1, wherein the pathogen is selected from the group consisting of *Erwinia* spp., *Pantoea* spp., *Pectobacterium* spp., *Pseudomonas* spp., *Ralstonia* spp., *Xanthomonas* spp.; *Salmonella* spp., *Escherichia* spp., *Lactobacillus* spp., *Leuconostoc* spp., *Listeria* spp., *Shigella* spp., *Staphylococcus* spp., *Candida* spp., *Debaryomyces* spp., *Bacillus* spp., *Campylobacter* spp., *Clavibacter* spp., *Clostridium* spp., *Cryptosporidium* spp., *Giardia* spp., *Vibrio* spp., *Xanthomonas* spp., and *Yersinia* spp.

4. The method of any one of claims 1 to 3, wherein the method comprises a treatment selected from the group consisting of treatment during field packing, treatment during palletization or after palletization, in open pallets or in wrapped pallets, in tents, in-box treatments with or without liners, in sea container, truck or other container types used during transportation, and treatment during storage.

5. The method of any one of claims 1 to 4, wherein the plants or plant parts are selected from the group consisting of corn, wheat, cotton, rice, soybean, and canola.

6. The method of any one of claims 1 to 4, wherein the plants or plant parts are selected from the group consisting of fruit, vegetables, nursery, turf and ornamental crops.

7. The method of claim 6, wherein the fruit is selected from the group consisting of banana, pineapple, citrus, grapes, watermelon, cantaloupe, muskmelon, and other melons, apple, peach, pear, cherry, kiwifruit, mango, nectarine, guava, papaya, persimmon, pomegranate, avocado, fig, citrus, and berries.

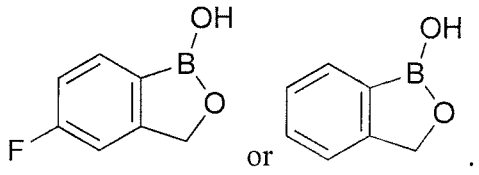
8. The method of claim 7, wherein the berries are selected from the group consisting of strawberry, blueberry, raspberry, and blackberry.

9. The method of claim 7, wherein and the citrus is selected from the group consisting of oranges, lemon, lime, and grapefruit.

10. The method of any one of claims 1 to 9, wherein the contacting comprises applying the volatile antimicrobial compound by ways selected from the group consisting of spray, mist, thermal or non-thermal fogging, drench, gas treatment, and combinations thereof.

11. The method of claim 10, wherein the gas treatment is selected from the group consisting of release from a sachet, release from a synthetic or natural film, release from liner or other packaging materials, release from powder, release from a gas-releasing generator, release using a compressed or non-compressed gas cylinder, release from a droplet inside a box, and combinations thereof.

12. The method of any one of claims 1 to 11, wherein the volatile antimicrobial compound has a structure of



.