



*Parboiled rice hulls in substrate media*

# Fungus Gnat Adults and Growing Media

How attractive are parboiled rice hulls and related media to this greenhouse pest?

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Fungus gnats (*Bradysia* spp.) are common greenhouse pests. The adults are primarily a nuisance, causing minimal plant damage. But eggs laid by adult females hatch into larvae that feed on roots and are directly responsible for plant injury. Growing media may vary in attracting fungus gnat adults.

The growing medium type and components may affect the population dynamics of fungus gnats by providing a favorable substrate for development and reproduction. In addition, fungus gnat adults may be attracted to or prefer moist growing media containing peat moss. This may provide an abundant level of fungal activity that is attractive to and serves as a food source for adult fungus gnats.

Parboiled rice hulls may be an alternative to perlite in growing media for the production of ornamental plants. But PBH's potential attractiveness to fungus gnats is not known. This is important because any growing medium component that attracts fungus gnat adults may lead to significant crop damage from larval feeding. So we conducted a series of seven experiments

to ascertain whether PBH or growing media containing PBH are attractive to adult fungus gnat.

We evaluated four different growing media: Sunshine LC1 Mix (75 percent sphagnum peat moss and 25 percent perlite), RH1 (80 percent peat moss and 20 percent rice hulls), SB200 (60 percent peat moss, 20 percent bark and 20 percent perlite), and RH20 (100 percent rice hulls).

All experiments were performed in a lab at Kansas State University and done in the dark because fungus gnat adults are attracted to light. We used a set of five experimental arenas with six arms and a central compartment made from a clear, round 5.3-liter polypropylene microwavable container with a snap-on lid.

The fungus gnat adults used in all the experiments (a mixture of males and females) were six to nine days old. Approximately 100 fungus gnat adults were released into the central compartment of each experimental arena and sealed inside.

Yellow sticky cards were positioned on the surface of each growing medium. Fungus gnat adult distribution in the sample compartments

## The Method

The seven experiments performed in the study:

**Experiment 1** — rice hull growing medium vs. perlite growing medium

**Experiment 2** — two different moistened growing media

**Experiment 3** — two different moistened growing media

**Experiment 4** — two different moistened growing media

**Experiment 5** — moistened vs. dry growing medium

**Experiment 6** — two different moistened growing media

**Experiment 7** — moistened vs. dry growing medium — same growing medium



*Figure 1*



was determined after 48 hours by recording the number of adult fungus gnats per yellow sticky card per treatment. Adult fungus gnats flying around the compartment or dead on the floor also were recorded.

### Steam Distillation Procedure

The volatile odor constituents of the growing media were determined using a steam-distillation procedure, which produced an extract that was analyzed and identified using gas chromatography. We used a mass selective detector and confirmed findings by authentic standards. Quantitative analysis was assessed by gas chromatography with a flame ionization detector.

### Results

**1 Experiment 1:** Rice hull growing medium vs. perlite growing medium  
This treatment was not significant; all the media (RH20, LC1, RH1 and SB200) had similar proportions of fungus gnat adults present in the sample compartments (Figure 2). The range of fungus gnat adults collected from the colonies and used in the experiment was between 90 and 120.

**2 Experiment 2:** Two different moistened growing media

Treatment was significant, with a higher proportion of fungus gnat adults in the sample compartments containing moistened RH20 (41 percent) compared to moistened SB200 (31 percent). The range of fungus gnat adults collected from the colonies and used in the experiment was between 75 and 170.

**3 Experiment 3:** Two different moistened growing media

Treatment was not significant, with a similar proportion of fungus gnat adults in the sample compartments containing either moistened LC1 (39 percent) or moistened SB200 (43 percent). The range of fungus gnat adults collected from the colonies and used in the experiment was between 75 and 130.

**4 Experiment 4:** Two different moistened growing media

Treatment was not significant, with a similar proportion of fungus gnat adults in the sample compartments containing either moistened RH1 (36 percent) or moistened SB200 (41 percent). The range of fungus gnat adults collected

from the colonies and used in the experiment was between 95 and 160.

**5 Experiment 5:** Moistened vs. dry growing medium

Treatment was significant, with a higher proportion of fungus gnat adults in the sample compartments containing moistened SB200 (52 percent) than sample compartments containing dry RH20 (17 percent). The range of fungus gnat adults collected from the colonies was between 80 and 140.

**6 Experiment 6:** Two different moistened growing media

Treatment was not significant, with a similar proportion of fungus gnat adults in the sample compartments containing either moistened RH1 (34 percent) or moistened LC1 (32 percent). The range of fungus gnat adults collected from the colonies and used in the experiment was between 100 and 170.

**7 Experiment 7:** Moistened vs. dry growing medium — same growing medium

Treatment was significant, with a higher proportion of fungus gnat adults in the

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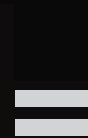


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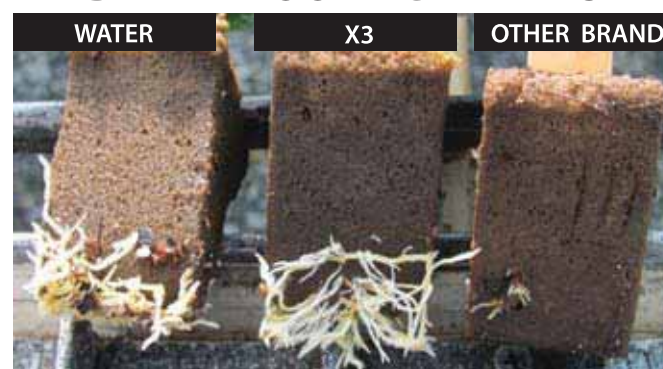
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sample compartments containing moistened RH20 (53 percent) than sample compartments containing dry RH20 (17 percent). The range of fungus gnat adults collected from the colonies and used in the experiment was between 110 and 180.

### Steam Distillation

The rice hull material had little, if any, discernible odor. RH1 had an odor similar to ordinary peat moss. LC1, which contains approximately 75 percent sphagnum peat moss, had more of a “mushroom”-like odor. SB200 had an “earthy” odor. In general, the aqueous steam distillate of each of these materials had an odor similar to “peat moss.”

The major components identified were very similar to the types of compounds previously identified from a commercial peat moss material. Components that were present included the fatty acids, dicarboxylic acids, furfural and 5-methylfurfural. Cyclosulfur was present in each of the commercially mixed growing media, but not in the rice hull material.

### Discussion

This study demonstrated that PBH are not attractive to fungus gnat adults. What appears to be most important in terms of fungus gnat adult attractiveness is the growing medium moisture content. It appeared that fungus gnat adults were attracted to moist growing media, and less attracted to growing media with low moisture contents (less than 10 percent), which may be associated with survival of fungus gnat eggs and larvae. In fact, fungus gnat larval survival is typically higher in a peat-based growing medium (35 percent to 45 percent sphagnum peat moss) with a moisture content between 52 percent and 71 percent compared to growing media with a moisture content less than 34 percent and maintained at 90 percent.

The growing media RH1 and RH20 are blends from a commercial vendor, with 20 percent and 100 percent PBH, respectively. Although the RH20 growing medium is supposed to contain 100 percent PBH, there were trace amounts of peat moss present,

enough so that a “characteristic” peat moss-like odor was detectable prior to analysis. We obtained a purer PBH sample from the vendor, which had no discernible odor.

To assess the odoriferous components of growing media, which may act as lures for fungus gnat colonization, this study focused on the volatile constituents.

The manufacturer of the PBH used in this study and subsequent experiments cleaned and subjected it to heat, similar to treatments that produce composted bark, which provides a material that may be incorporated into growing medium. Aqueous or organic solvent extracts of rice residue (or any plant residue) should yield the very complex phenolics, triterpenes and steroidal constituents that have been identified in rice. But none of these compounds were detected in the collected steam distillate. Instead, fatty acids, primarily palmitic and stearic acid, were the main constituents, with small amounts of shorter-chain fatty acids and diacids.

The most abundant constituent in the dried PBH, as determined by gas chromatography analysis was palmitic acid, a saturated straight-chain acid commonly present in plant material. The higher concentrations obtained in the rice hulls most likely indicate that this material has not undergone sufficient physical decay with the hulls still intact. In materials such as peat moss or composted bark, which are exposed to a specific degradation treatment, the long chain fatty acids are fragmented into shorter chains or more oxidized components.


Minimal quantities of furfural and methylfurfural, as well as dodecanol were also detected. Both the RH1 and RH20 material had similar profiles; however, additional volatiles were present that were detected in the LC1 and SB200 material. Furthermore, cyclosulfur was detected in each of the commercially available growing media, with the highest amount in the



Adult fungus gnat

RH1 growing medium (80 percent peat moss).

This study was designed to assess the attractiveness of PBH when incorporated in growing media to fungus gnat adults. As such, we

have demonstrated that adult fungus gnats do not appear to prefer PBH compared to other growing-medium components. This indicates that greenhouse producers may use PBH as a media amendment without concern for luring fungus gnat adults and sustaining plant damage. 

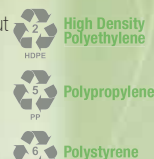
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Fungus gnat larvae

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