



Temperature Effects on Biology of Common Stored Product Insects



| Insect Species | Low Temperature Effect | | Temperature for Population Growth | | High Temperature Effect | | |
|--|--------------------------|-------------------------|-----------------------------------|---------------------|-------------------------|----------------------------|-----------------------------|
| | Extreme 100% Kill | Moderate 100% Kill | Lower Limit | Optimum Temperature | Upper Limit | Moderate 100% Kill | Extreme 100% Kill |
| Granary Weevil <i>Sitophilus granarius</i> | 5°F / -15°C 24 hours | 18°F / -8°C 14 days | 52°F / 11°C | 81°F / 27°C | 82°F / 28°C | 105°F / 41°C 12 hours | 130°F / 54°C 30 minutes |
| Rice Weevil <i>Sitophilus oryzae</i> | 5°F / -15°C 24 hours | 18°F / -8°C 3 days | 59°F / 15°C | 84°F / 29°C | 93°F / 34°C | 102°F / 39°C 17 days | 105°F / 41°C 1 hour |
| Lesser Grain Borer <i>Rhyzopertha dominica</i> | 14°F / -10°C 4 hours | 23°F / -5°C 10 hours | 64°F / 18°C | 93°F / 34°C | 100°F / 38°C | 109°F / 43°C 4 days | 131°F / 55°C 1 hour |
| Cigarette Beetle <i>Lasioderma serricorne</i> | 14°F / -10°C 8 hours | 23°F / -5°C 4 days | 63°F / 17°C | 90°F / 32°C | 97°F / 36°C | 109°F / 43°C 4 days | 122°F / 50°C 24 hours |
| Warehouse Beetle <i>Trogoderma variabile</i> | -2°F / -19°C 10 days | 14°F / -10°C 30 days | 64°F / 18°C | 90°F / 32°C | 104°F / 40°C | 113°F / 45°C 30 hours | 122°F / 50°C 12 hours |
| Sawtoothed Grain Beetle <i>Oryzaephilus surinamensis</i> | 14°F / -10°C 24 hours | 23°F / -5°C 15 days | 63°F / 17°C | 90°F / 32°C | 102°F / 39°C | 113°F / 45°C 12 hours | 125°F / 52°C 1 hour |
| Red Flour Beetle <i>Tribolium castaneum</i> | 23°F / -5°C 24 hours | 37°F / 38°C 28 days | 68°F / 20°C | 97°F / 36°C | 97°F / 36°C | 113°F / 45°C 30 hours | 122°F / 50°C <30 minutes |
| Confused Flour Beetle <i>Tribolium confusum</i> | 21°F / -6°C 24 hours | 32°F / 0°C 9 days | 63°F / 17°C | 90°F / 32°C | 90°F / 32°C | 111°F / 44°C 24 hours | 122°F / 50°C <30 minutes |
| Indianmeal Moth <i>Plodia interpunctata</i> | -2°F / -12°C 1 hour | 108°F / -12°C 7 days | 64°F / 18°C | 86°F / 30°C | 95°F / 35°C | 113°F / 45°C 2 hours | 131°F / 55°C 30 minutes |
| Mediterranean Flour Moth <i>Anagasta kuehniella</i> | 0°F / -18°C 1 day | 14°F / -10°C 10 days | 46°F / 8°C | 77°F / 25°C | 82°F / 28°C | 113°F / 45°C 30 minutes | 131°F / 55°C <30 minutes |

*The temperature data are derived from laboratory reared insect cultures. Insects acclimated to cold temperatures will require colder temperatures and/or longer exposure times. From Paul Fields (1992), Tom Strang (1992)

John Mueller, president of FSS stated:

"Cold temperate fumigations are often unsuccessful. Why? Stored product insects have the ability to shutdown their respiration, hibernate, and tolerate phosphine for up to 10 days at low temperatures. Warm grain and structures offer better conditions for 100% mortality of all stages of insect life. The insects can shut down their bodies during the cold winter months and survive sub-zero temperatures outdoors by creating a glycol antifreeze to lower the freezing of liquids in their bodies. A fumigant label may say that you can use the product below 60°F / 15°C but this takes much longer to be effective. The difference of a complete kill with 200 parts per million of phosphine at 90°F / 32°C and 40°F / 5°C may be 10 times longer for the colder temperature. Fumigation failures often occur because applicators don't allow for the correct duration to allow the solid phosphine formulation to break down, penetrate the grain, and affect a kill. Not only the insect adults but the tolerant eggs and pupae stages are not as active and thus don't inhale the fumigant as much. Remember the saying when using phosphine: **The longer the better.**"

VISIT US AT: www.fumigationzone.com