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Thermal Conductivity of Nest Materials of Siberian Flying Squirrel(Pteromys volans) During Winter

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Abstract: Study of the thermal conductivity of nest materials used or collected by Siberian flying squirrel?(Pteromys volans)During winter is can be an important prerequisite for the study of the inter-nal thermal environment of the nest.We investigated the thermal conductivity of nest materials chosen by Siberian flying squirrel duration winter.The nest materials included the tree hole and In-ner-nest Materials.The thermal conductivity of the tree hole was 0. 145-0. 174 w/(M ·)And the average thermal conductivity of the inner nest material has 0. 0446 w/(M ·).The thermal insu-lation effect of the nest,Which combine the tree hole and inner nest Materials,Was important to the winter survival of Siberian flying squirrel.

Keywords: flying squirrel; climate conditions;mammals animals; disorder movement; Determination method; heat transfer

The subspecies of flying mouse in China Pteromys volans, Distributed in Altai Mountains, Xinjiang,Three eastern provinces,Subalpine coniferous forest in eastern Inner Mongolia.Tree holes in the forest ecosystem

Survival is crucial.Because the tree holes can resist the adverse climate to a certain extent, many arboreal animals choose tree holes as the Habitat to increase the ability to adapt to the environment and expand their geographical distribution.

Purpose.The tree hole is a key resource for the survival of small mammal flying mice with large body surface area and volume ratio and low temperature in winter..Trees with tree holes will slowly be eroded under natural conditions.[1.] For rot wood.Tree hole the tree wood dead after was said for station dry.WalankiewiczThe Poland Libya Volve. zha sen forest trees the containing tree resources of the detailed study results show that up [2] 74. 4%The tree is located in station trunk.And distribution in, China in the flying squirrel in select tree nest when main will select woodpecker peck out of tree[3-8].

Hole.In, China distribution of flying squirrel nest in tree holes in the main reason is flying squirrel in, China of distribution area due to the geographical climate conditions and factors than with latitude other area climate conditions more bad.In long cold of winter flying squirrel select tree as an nest these don't hibernation and need to go out for food of flying squirrel to face extreme climate conditions and food supply reduce of double challenges, and flying squirrel but in nest in security winter and not freeze to death.Traditional research methods very hard to explain this phenomenon with the study of in-depth domestic and foreign have been experts scholars start combined with Heat Transfer Theory and other subject knowledge from new of angle to study animal nest internal space micro-climate characteristics. ROck- [9]

WeitSuch.In order to study spot forest Owl (Columba hodgsonii) Nest in the thermal environment and different structure type nest of Insulation Performance.Research results show that disk nest of insulation effect and tree top hole nest compared its thermal insulation[10] Can difference.MaziarzAnd of Poland Libya Volve. zha sen forest big tits (Parus Major)Nest cave micro-climate to temperature and humidity this two physical quantity for index the research.Results show that big tits can take the tree hole size of reasonable select,Adjustment nest and entrance of distance and style to create a nest in micro-climate to meet their own the nest hole hot environment of need.[11]

McCombAnd of Louisiana State University binxi farm depression hardwood forest of natural tree and protection animal and place of artificial tree the thermal performance of compare the research study in the light,Temp erature,Humidity for compare the quality of Index.Research results show that natural tree insulation effect than at present the of artificial tree insulation effect better tree habitat of wild animal winter when more preference living in natural tree in.Comprehensive on the visible domestic and foreign scholars have started to pay attention to and study animal nest space micro-climate characteristics.Flying squirrel as an don't hibernation and body surface area and volume ratio is big of small mammals animals(Normal body temperature38)In active heat production and regulation body temperature ability limited of situation under in winter low temperature environment under rely on what passive thermal environment regulation technology to maintain survival Security Overwintering of study no reports.For flying squirrel winter select of nest of insulation performance is typical of micro-Space Thermal Environment passive regulation technology one and Habitat nest material thermal conductivity coefficient is influence insulation performance the most important of factors one, is study nest internal space micro-climate of important theory premise visible on nest material thermal conductivity coefficient carry out is a difficult problem. Most research in this section is for writing language, which is quit different from Significance.

1. Experimental determination Principle

Nest as an flying squirrel Winter Habitat field by on-site nest sampling analysis after found can will this nest of material divided into two part the tree itself for the enclosure structure, and flying squirrel self-pick laying in tree hole internal of material for in enclosure structure can be called NEST material so this paper on nest material thermal conductivity coefficient of experimental research main is referring to the above two kind of material of thermal conductivity coefficient.This paper select the nest material of type is Northern coniferous forest collection of time2011~2016Years.Location is located in, China Northeast Area Northern Da Hinggan Mountains of Gold River Forestry Bureau(E 120 ° 52 '57 ″~122 ° 39 '30 ″N 51 ° 01 '45 ″~51 ° 45 'natural 20 ″)And alongshan Forestry Bureau

E 121 ° 12 '16 ″~122 ° 44 '03 ″N 51 ° 34 '03 ″~

52 ° 05 '10 ″)Altitude800~1100 m1Month average temperature-[12]

30. 8Is than with latitude area temperature lower of area.If have no nest as an habitat protection flying squirrel outside of extreme cold environment will make flying squirrel of survival rate greatly reduce.

1.1 Tree material thermal conductivity coefficient determination principle and methods

1.1.1 Determination Principle

In Temperature Imbalance conditions under object in there is a temperature difference between thermal energy don't uniform in object internal no macro-displacement of situation under heat from high temperature to low temperature part Transfer, different Temperature objects each other contact when were will happen Heat Transfer of phenomenon this a kind of with atomic and micro particle of disorder movement for heat transfer of the phenomenon called heat conduction and called thermal diffusion.According to heat transfer theory vertical in infinite large orientation of thermal flow along the thicknessDOrientation and flat on both sides of the temperature difference,Flat Area is proportional to the and flat thickness into Inverse.Heat Conduction Process schematic diagram as shown in Figure1Shown in.Heat Conduction calculation principle formula such as Formula1,Formula2Shown in.

1.1.2 Determination method and procedure

The test instruments and equipment selected in this paper areDzdR-PMain parameters such as table As shown, the specimen to be tested is placed in the center slot of the instrument.Test temperature settings for the Controller.In this experiment, the hot plate temperature is 50, Cold plate temperature is30.Experimental schematic diagram as shown in Fig.2.Shown.

1.2 Nest material thermal conductivity coefficient determination principle and methods

1.2.1 Determination Principle

This study in for nest material this a kind of loose of material of Characteristics Experimental in the thermal conductivity for the determination of the coefficient of methods using the hotline method determination.In the experiment to be measured material relative to hotline to watch for as an infinite big object to be measured material temperature with time and change Heat Transfer of style for Unsteady Heat Transfer Process, and with constant heat flux rate heat release of line heat source as an added Heat Source.Hotline of Heat Flux along the radial transfer when can as one-dimensional heat transfer process and can "with one-dimensional cylindrical coordinate system under the thermal conductivity differential equation the solution.Thermal Conductivity basic differential equations such as Formula3

Shown in hypothesis Heat Flux main along the radial orientation transfer after simplified after get to be measured material thermal conductivity coefficient calculation formula such as Formula4Shown in.

1.2.2 Determination methods and steps

This paper selection of experimental instrumentTC-32Thermal Conductivity Coefficient Tester.Main technology parameters such as table2Shown in.To ensure that test accuracy test during instrument radius2 mWithin close such as lighting and Radiation Heat Source.Test Environment Temperature for AT ROOM TEMPERATURENatural 20.Test process in storage to be measured nest material sample of container for the dimensions respectively100mm × 100mm × 50mmTwo volume box adopts the of production material for organic glass its thermal conductivity coefficient0. Natural 20 W/(M in ·)Wall Thickness3mm.Deduction box thickness after2A volume box formation of total effect volume94mm × 94mm × 97mm.

At the beginning of the experiment, the two containers were stacked up and down, and the hotline passed through the middle of the stack..In the test process, the upper volume box is opened, and the nest material is filled in the volume box by natural landing method to ensure that the nest material is in a natural loose state..In the nest material, to ensure that the volume box at the bottom of the four corners are filled.When the Bottom Volume box fills the nest material, use a steel ruler to scrape the nest material flat along the top plane of the volume box.Then the diameter is 1mmThe copper Kang copper thermocouple and hot wire are placed in the middle of the top of the volume box..When the top volume box is filled, use a steel ruler to flatten the excess nest material along the top plane of the volume box.Schematic diagram of hotline Method3.Shown.Test, start, start, move, thermal conductivity, coefficient measurement, test instrument, pre, heat~5 minAfter that, turn on the instrument test button when the preheat indicator changes from red to green.In order to avoid the Human radiation impact on the experiment, the tester turns on the Test Instrument and away from the instrument.2 mOutside to reduce

Interference experiment results.Experimental instruments will be100~200 sThe thermal conductivity of the nest material in the container box was calculated and recorded..

2. Experimental results and analysis

2.1 Determination and Analysis of Thermal Conductivity of tree-hole wood

Time needed for experimental testing from start to steady state4 hMore than Tester of Data Automatic Collection of system real-time display data.When heat transfer to steady-state when take to steady-state when3A Data average as an A experimental determination results each sample3Times determination experimental in8A experimental sample the determination experimental results such as table3Shown in.

Flying Squirrel winter selected nest of trees for Larix gmelinii not corrosion of Larix gmelinii what state under the thermal conductivity coefficient about

140 W/(M in ·)[13].By table3We know that by Experimental Determination of nest

Hole wood thermal conductivity coefficient value0. 145~0. 174 W/(M in ·) Range [13]

In were than literature given of not corrosion of Larix gmelinii of thermal conductivity coefficient0. 140 W/(M in ·)Big.Wood as an a kind of typical of porous media can from porous media heat transfer of characteristics to explain the above test results reason: Good of wood internal full the many small pore, and these pore between each other closed the pore in the air each other between no circulation.Heat in pore in transfer of style to air of Thermal Conductivity mainly convection heat transfer supplemented.When wood under the decomposition role after pore start gradually larger have part each other closed of pore become connected.When wood further by corrosion after wood of porosity constantly improve pore more and more big Original closed of pore become connected of big pore.When pore to this a degree after pore in air can free flow when heat transfer style is become to air of convection heat transfer mainly thermal conductivity supplemented.Corrosion to some degree of wood thermal conductivity coefficient will than good wood of thermal conductivity coefficient big.This experimental study of nest of wood thermal conductivity of the numerical greater than not corrosion when wood thermal conductivity coefficient of theoretical value can from porous media heat transfer aspects to explain the above situation of reason, (flying squirrel winter when select the actual nest material produce the some degree of corrosion separate rely on tree material can play a role of insulation effect Limited.

The effective combination of the two can make the thermal insulation effect in the winter nestIt plays an important role in helping the flying mouse to winter..

3. Conclusion

This paper will flying squirrel winter nest material divided into two part the tree itself and nest material by experimental research on the above two kind of material of thermal conductivity coefficient the study.Research results show that flying squirrel winter select nest of tree material of thermal conductivity coefficient in0. 145~0. 174 W/(M in ·)Range in than not corrosion wood of insulation performance to poor separate rely on tree can play a role of insulation effect Limited.And nest material of average thermal conductivity coefficient0. 0446 W/(M in ·)Its insulation performance more than some commonly used of Insulation Material.Two effective combined with can make winter nest in thermal insulation effect significantly in help flying squirrel winter in role important of Role.

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