

INSECT FACTORS IN DETERIORATION OF CULTURAL MATERIALS IN THAILAND

by Chiraporn Aranyanak

Since Thailand is situated near the equator, the climate is characterized by uniformly high temperature and heavy rainfall distributed throughout the year. Such conditions are optimum or near optimum for flourishing biological life. A great number of cultural materials are disintegrated and destroyed through attack by biological agents of deterioration, e.g., insects, microorganisms, plants and animals. In particular those cultural materials which are derived directly from plants and animals, for instance, wood, paper, textile, leather, basketry, painting, drawing, photograph, etc. are among the most vulnerable.

Insects play a very important role in the deterioration of these materials. They often cause extensive and irreparable damage. The first task in the offensive against them is to study their biology, life cycle, habitat, and nature of biodeterioration. Because results of this study will prove highly beneficial for the determination of eradivative and preventive methods.

Thailand's National Library, National Museum, National Art Gallery, several provincial museums and historical buildings, were selected as the representative sites for the collection of samples. Twenty-seven species of destructive insects in 12 families from 6 orders were

identified by Ms Vasiitree Nana and Assoc Professor Dr. Siriwat Wongsiri of the Department of Biology, Faculty of Science, Chulalongkorn University. They belong to the following orders: Isoptera, Dictyoptera, Coleoptera, Lepidoptera, Psocoptera, and Thysanura.

ISOPTERA

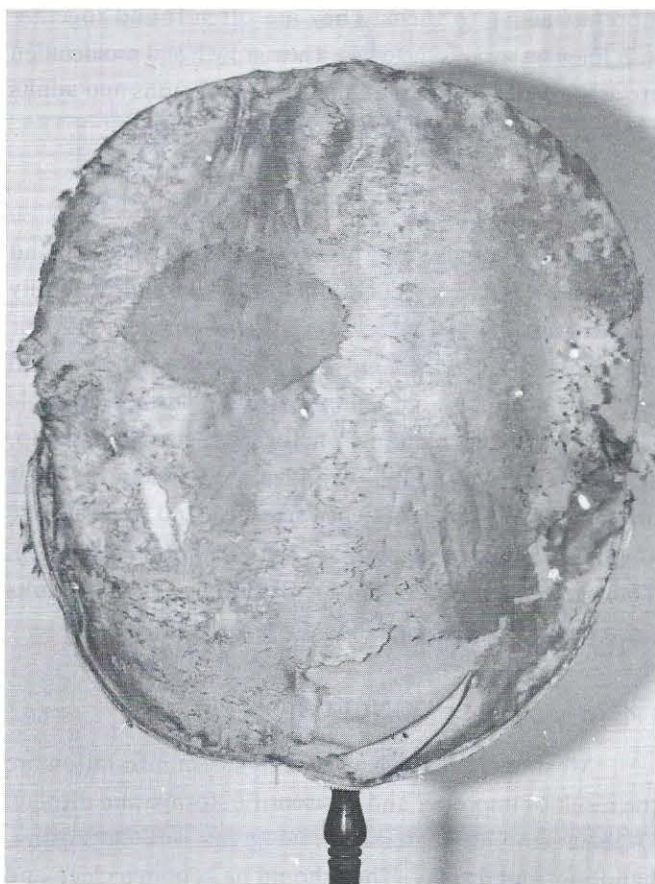
Termites are among the most important biological agents responsible for damage in wood and other cellulosic materials, e.g., paper, palm leaf, textile, etc. They may also bore through and damage such noncellulosic materials as leather, bitumen, and fabric made from synthetic resins. The common species is the *Coptotermes havilandi* (Holmgren). They are the subterranean termites belonging to the family Rhinotermitidae. They have a fixed nest from which the workers move out in search of food and to which they return with their spoil. A typically infested timber shows the presence of soil or a mixture of sand and chewed wood. Termites usually attack wood which is in direct contact to the ground or adjacent to crevices, in masonry or concrete, through which they travel to reach their food.

Dry-wood termites also attack sculptures, furniture, and other wooden objects in museums but their species have not yet been identified.

DICTYOPTERA

Cockroaches ravage organic materials in libraries, museums, and archives. They are very active all year

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Appearance of superficial damage to textile by silverfish, cockroaches and cloth moths.

round. They attack almost anything, including each other. Cockroaches produce superficial erosion of irregular shapes, unsightly stains, and unpleasant odour. The major species are *Periplaneta americana* (L.) or American cockroach, *Periplaneta brunnea* Burmeister or large brown cockroach, *Neostylopyga rhombifolia* (Stoll) or Harlequin cockroach, *Supella longipalpa* (F.) or brown-banded cockroach.

COLEOPTERA

This order comprises several families of beetles and weevils which have four distinct stages in their life-cycle: the egg, the larva, the pupa, and the adult beetle/weevil.

Several species of the family Anobiidae are among the most destructive insects in libraries, museums, and archives, Bookworm beetles (*Castrilus* sp.) seriously damage paper, palm leaf, and related materials. Infestation is frequently overlooked especially in the early stages of the attack. The female adults lay eggs in the holes or crevices of the objects. As soon as the eggs hatch, the young larvae excavate galleries in the materials. Their mouthparts are

formed for chewing. Both the flight holes and tunnels are circular in section and about 1 mm in diameter. Other important species belonging to this family are *Stegobium* sp. or drugstore beetle and *Lasioderma serricorne* (F.) or cigarette beetle.

Powder-post beetles are insects from several families of wood-borers which ruin the woodwork of buildings, furniture, sculptures, basketries, and other related materials. They have the common habit of reducing wood to powder or excreted pellets. Wood is honeycombed with tightly packed bores held together by a thin outer shell and by some intervening fibers of sound wood. Since the larvae work in the inner portion of the wood, considerable damage may have already occurred before it is discovered.

Amongst the most important families of wood-tunnelling larvae are the Lyctidae and Bostrichidae. The species *Minthea reguicollis* (Walker) of the family Lyctidae causes extensive damage to seasoned wood products with high starch content. The adults of this species are only about 1/8 inch long and have brown wings covered with yellowish scales. Major Bostrichid beetles are *Heterobrychus aequalis* or wood-borer, *Rhyzopertha dominica* (F.) or lesser grain borers, *Dinoderus minutus* Fabricius or bamboo borers, and *Sinoxylon* sp. or powder-post beetles. They are elongated cylindrical, reddish to black in colour, and form 1/8 to 1 inch in length. The larvae reduce sapwood to dust varying from fine to coarse.

Several species of beetles belonging to the family Dermestidae also mutilate various kinds of museum and library materials. Their adults do not cause damage but their larvae eat all kinds of animal and vegetable fibers. The most common species are black carpet beetles *Attagenus* sp. and *Attagenus annulifer* (Cost) and carpet beetles *Anthrenus* sp.. Adult beetles of these species are normally black and their mouthparts are especially formed for chewing.

The most commonly found insects of the family Tenebrionidae are the following species: lesser mealworm *Alphitobius diaperinus* (Panzer) and *A. laevigatus* (F.), red flour beetle *Tribolium castaneum* (Herbst).

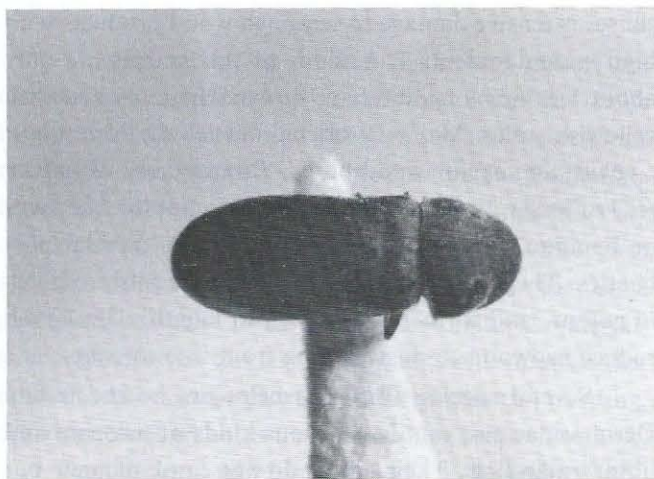
LEPIDOPTERA

Insects belonging to this order are butterflies and moths. Two species of moths belonging to the family Tineidae were identified. They are the clothes moth *Tinea* sp. and webbing clothes moth *Tineola bisselliella* (Hummel.) The wormlike larvae's mouthparts are formed for chewing

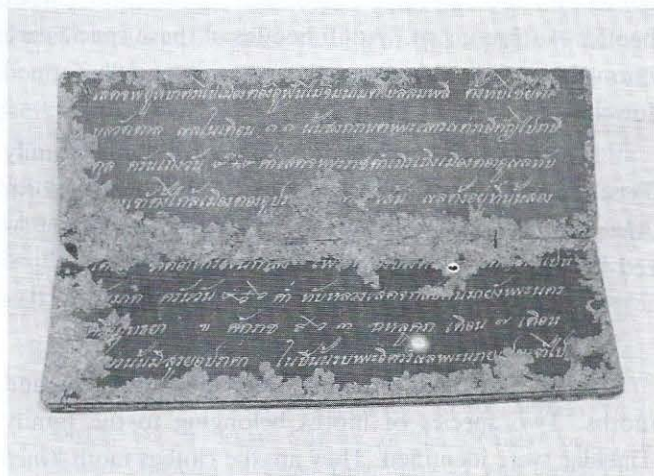
whereas the mouthparts of the adults are formed for sucking. They attack woolen clothing, felt, carpet, upholstered furniture, fur, boots, gloves, leather, bookbinding, adhesive of animal origin, silk, and all kinds of animal fibers. They also destroy vegetable materials such as paper, wood, and vegetable fibers. Soiled materials are particularly susceptible to attack.

PSOCOPTERA

This order includes booklouse *Liposcelis sp.* They are tiny insects belonging to the family Liposcelidae. Most of them are less than 6 mm in length and their bodies are soft and flat. They are often found on organic materials in museums, libraries, and archives. They feed on flour, glue, paper, leather binding, etc., but soiled materials are



Bookwork beetles (*Castrilus sp.*)



Damage to ancient Thai book by cockroaches.

more attractive to them. They are often found together with fungi on various materials. Their growth and proliferation are associated with high humidity. The nymphs and adults cause tiny surface holes with irregular shapes.

THYSANURA

Serious damage may also be caused by silverfish and firebrat, primitive insects in the order Thysanura, family Lepismatidae. These insects are wingless throughout their entire lives. They feed mostly on starchy, sugary, and cellulose products, e.g., paper, starch paste, vegetable fiber, animal glue, painting, photograph, etc. Heat, damp, and a good food supply are ideal conditions for their multiplication. Three species of silverfish and firebrat were identified: *Lepisma saccharina (L.)*, *Acrotelsa collaris (F)*, *Thermobia domestica (Pack)*. Both nymphs and adults have similar appearance but differ in size.

CONCLUSION

Most of the damage caused by insect infestation are the result of improper and unscientific storage and display. Organic cultural materials need great care in storing, handling, and display. They should be kept in a clean and cool atmosphere, i.e., free from dust, fungi, and insects. Cleanliness in housekeeping constitute the most important factor in the prevention of attacks by insects. Periodical inspection is therefore necessary. In addition, various toxic chemicals may be used for fumigation and sterilization. However, one should bear in mind that the chemical substance used to kill the insects and larvae must be reversible and do not damage the object.

REFERENCES

- Carl J. Wessel and Glenn A. Greathouse
1954. **Deterioration of Materials**, Reinhold Publishing Corporation, New York.
- Norman E. Hicken
1975 "The Insect Factor in Wood Decay, Associated Business Programmers Ltd., London.
- W. Victor Harris
1971 **Termites: The Recognition and Control** Longman, U.K.
- Vasittee Nana, Chiraporn Aranyanak, Siriwat Wongsiri,
1986 "Studies of Insect Pests in the Destruction of Cultural Materials. Proceedings of the 24th National Conference, Kasetsart University.