INSECT LIFE
IN THE
POETRY AND DRAMA
OF
ENGLAND

INSECT LIFE IN THE POETRY AND DRAMA OF ENGLAND

(With Special Reference to Poetry)

By

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A THESIS

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"When God said:
'Let the earth bring forth soul living in her kind,
Cattle and creeping things, and beast of the earth,
Each in his kind!'. . .
At once came forth whatever creeps the ground,
Insect or worm: those waved their limber fans
For wings, and smallest lineaments exact
In all the liveries decked of summer's pride,
With spots of gold and purple, azure and green;
These as a long line their long dimension drew,
Streaking the ground with sinuous trace;".

Paradise Lost (Bk.VII): Milton

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"Hark, how thro' the peopled air
The busy murmur glows!
The insect youth are on the wing,
Eager to taste the honied spring,
And float amid the liquid noon:
Some lightly o'er the current skim,
Some shew their gaily-gilded trim
Quick-glancing to the sun."

Ode to Spring: Gray.

In view of the aesthetic appeal and the omnipresence of insect life, it would have been strange indeed if these pestiferous, but interesting little creatures had not found a place in the splendid panorama of English poetry and drama. The English poets, including the dramatic poets, down through the centuries have expressed their love of nature and the rural delights of their beautiful country in song and verse, perhaps more than the poets of any other land. In doing so, they have not overlooked the insects, which form an integral part of any rural scene. Even the insects of home and fireside, not to mention more intimate forms, have received a measure of their attention.

In this work an attempt has been made to bring together a representative selection of allusions to insects found in the poetry and drama of England, and to present them in an organized manner with relevant information of an interesting and useful character. The aim has been to

inform as well as to entertain, and it is hoped that the work will stimulate an interest in entomology among students of literature, and perhaps encourage entomologists to a greater appreciation of the wonderful literary heritage of all who speak the English tongue.

The insect allusions in the following chapters have been gathered from poetical and dramatic works representative of the period of English literature extending from Chaucer to modern times, a period of nearly six centuries. The concordances to the complete works of several of the more important English poets proved invaluable in this study, and may be found listed among the references at the end of the paper. Covering the minor poets and the dramatists adequately proved a more difficult task, and involved consulting anthologies and collected works of the various authors, and glancing over many hundreds of thousands of lines of poetry. Another helpful source was the entomological texts of past years, which were often embellished in appropriate places by their authors with quotations from the poets. After commencing this project, I soon found that the field was not an entirely virgin one, but had been cultivated to some extent by several writers, including Wilbur (67), Eddy (17), and Walton (60). Among these the work of Walton is especially worthy of mention, for he discussed the subject in a rather brief but facile and entertaining manner from the

standpoint of the entomologist. The present work, however, is much more comprehensive in scope than the papers referred to, and radically different in method of treatment.

The insect allusions in the Authorized Version of the Bible are quoted in addition to those in poetry and drama, in view of the enormous influence this great book has exercised on the English language and literature, and the undeniable beauty and poetic form of its matter. It should be observed, too, that a large proportion of the insect allusions found in the dramatic works of Shakespeare are included. Published papers by Fyles (25) and Turner (58) were helpful in this connection. It is not pretended, of course, that this work embodies all references to insects found throughout English poetry and drama. That would be a stupendous task, and of doubtful value. It is believed, however, that the quotations found herein, and the insect forms with which they deal, are truly representative.

In presenting them, the system of insect classification adopted by Imms (30) has been followed, in general, as will be apparent from a perusal of the chapter headings. This system is comprised of twenty-three orders, eleven of which are represented here, including all the larger and more important groups of insects. The orders in turn are considered by family groupings according to the genera and species involved in the allusions, wherever these could be

identified with any degree of certainty. A chapter is also devoted to the order Araneida, or spiders, which are not insects, but belong to the related class Arachnida.

The question might be raised as to the propriety of writing a contribution of this nature, with the world in the throes of a devastating war. One reason for doing so is of a personal nature. Spiritual comfort and strength, and renewed faith in the ultimate triumph of freedom in the face of adversity and threatened disaster are to be found in the glowing pages of English history and literature. As Wordsworth so beautifully expressed it, in the following sonnet written in 1807:

> "It is not to be thought of that the Flood
> Of British freedom, which, to the open sea
> Of the world's praise from dark antiquity
> Hath flowed, 'with pomp of waters unwithstood',
> Roused though it be full often to a mood
> Which spurns the check of salutary bands,
> That this most famous stream in bogs and sands
> Should perish; and to evil and to good
> Be lost forever. In our halls is hung
> Armoury of the invincible Knights of old:
> We must be free or die, who speak the tongue
> That Shakespeare spake; the faith and morals hold
> Which Milton held.—In everything we are sprung
> Of earth's first blood, have titles manifold."

Accordingly, as one who in his early youth served as a soldier throughout the last war, and whose only son is completing his training for service on wings in this, I felt justified in employing my leisure hours in a study of England's inspiring literary history. Another, less personal, but perhaps more important reason for preparing this work related

to the insect menace. Insects in peace time are a serious threat to humanity: in war they represent an even greater danger. Therefore, anything that serves to disseminate accurate knowledge concerning them is of value in facilitating combative measures against them. To that high purpose this manuscript is dedicated.

In concluding this brief introduction, I wish to express my grateful thanks to Dr. Arthur Gibson, formerly Dominion Entomologist, for the encouragement he gave me in the preparation of this work, and to his successor Mr. L.S. McLaine, for similar encouragement, and permission to use the illustrations which appear in these pages; also to Dr. F.J. McDonald, Professor of English Literature, of the University of Ottawa, for kindly advice and helpful suggestions. Special thanks are due to Miss Viola Lynn for her careful and accurate work in typing and checking the manuscript.

CHAPTER I

Some Remarks on the Insect Menace, and a Brief Outline of the History of Entomology in Relation to Allusions in Poetic and Dramatic Works

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The Insect Menace.

"Ten thousand forms! ten thousand different tribes!
People the blaze."

The Seasons: Thomson.

Down through the ages insects have played an immeasurably important part in the life of man, a part that only in comparatively recent times has begun to receive adequate appreciation. From the point of view of numbers of species and of individuals the insects dominate the earth. Their species comprise nearly three-quarters of the known animals in the world, the described forms probably exceeding 600,000. They reproduce at a remarkable rate, and are wonderfully well adapted for existence under the most diverse conditions in all parts of the earth.

With few exceptions, insects are man's relentless enemies, and compete with him in every walk of life. They do an immense amount of damage to crops, including forest trees as well as food plants, stored foods, wearing apparel and other forms of property. In addition, they annoy man

with their obnoxious presence; pollute his food with filth, or disease germs; attack him with poisoned stings, or suck his blood and infect him with pathogenic organisms which annually cause the deaths of millions.

Fortunately, insects are limited in size, otherwise their chances of destroying mankind might have been greater. This limitation is imposed by their method of breathing, which is radically different from that of warm-blooded animals and involves conveying air directly to the tissues in all parts of the body through a complicated tracheal system, instead of by means of haemoglobin in the blood, as in the case of mammals and other vertebrates. Furthermore, insects wear their "skeletons" on the outside as defensive armour, the muscles being attached to the inner surface. Consequently, whenever they increase in size during their development from the young larva or nymph stage to the adult form, after which no further increase takes place, it is necessary for them to shed their "skeletons" and develop new ones in a process called moulting. This also is a size-limiting factor. It is fortunate, too, that many insects devote all or part of their lives as parasites or predators upon other insects, and help tremendously in keeping their numbers in check. The comparatively new and promising field of biological control is based on this fact.

However, not all the activities of insects are detrimental to mankind. They must be credited with invaluable

services in fertilizing the flowers, a function which is essential in the production of seed and fruit. Many insects, too, perform an important service as scavengers, disposing of dead and decaying organic matter. Silk, honey, and wax are manufactured by insects and have been of immense value to man from earliest times.

A Brief Outline of the History of Entomology*

It was probably the utilization and development of silk and honey that gave man his first interest in the study of insects, although the ravages of such pests as locusts, and the intimate attentions of lice, fleas, and mosquitoes must also have stimulated his curiosity in these formidable little creatures.

Up to the time of the ancient Greeks there is no record of the existence of any considerable organized body of information about insects. The Israelites, and the ancient Egyptians, of course, were familiar with the commoner useful and troublesome forms, as revealed in the Bible and other early records, and there was doubtless a great deal of general, and probably largely inaccurate, information in circulation through the medium of folk lore, legend, and story. Aristotle (384-322 B.C.) in his "History of Animals", made

*In the preparation of this section I consulted papers by Leach (32), Marlatt (35), Dixey (15), Howard (29), and Weiss (62).

the first important attempt of which there is record, to carry out a scientific study and classification of animals. Although the number of insects he dealt with was limited to forty-seven generic varieties (vide Marlatt) he was considered the greatest authority on the subject for nearly two thousand years, and his attempt to develop a system of insect classification earned for him the honour of being called the father of scientific entomology. Nearly four centuries after Aristotle, the Roman, Pliny included and amplified the former's observations in the eleventh book of his "Natural History".

Then followed the long period of universal mental stagnation of the Middle Ages, during which there was an absence of original observation, and scientific knowledge suffered an eclipse. About the twelfth century, however, thanks largely to the Arabs, Greek science began to spread into Western Europe, and some time later, the Emperor Frederick III of Hohenstauen had Aristotle's writings translated into Latin, a translation that served as the basis of studies by scientists of the later Middle Ages. Another great man who facilitated the spread of knowledge and stimulated interest in nature was Albertus Magnus, at one time Bishop of Regensburg. This thirteenth century scholar faithfully copied and edited the writings of Aristotle and thus brought them more widely to the attention of the world.

The spread of scientific knowledge and the general renewed interest in Greek culture that took place in the fourteenth and fifteenth centuries, the invention of printing and the discovery of the New World, gave a tremendous impetus to the study of the natural sciences. Unfortunately, this renewed interest in nature for some time did not extend to insects, and up to the middle of the seventeenth century the number of serious students of entomology in Western Europe was small.

Probably the first work of any significance on entomology to be published in the British Isles was Thomas Mouffet's Insectorum sive minimorum Animalum Theatrum, which appeared in 1634, some time after Mouffet's death. This work is rare, and there does not appear to be a copy in Canada, which is a pity. It is reported to consist of one volume folio; illustrated with wood cuts, and to contain the insect lore of the ancients copied from Aristotle, Pliny and others. An English translation of it was published in London by Topsell (57) in 1658. The original work had a curious history. According to Marlatt (35), it was started by Conrad Gesner of Zurich, who died of the plague in 1565 before completing it. Gesner's notes, together with those collected by Dr. Edward Wotton, were acquired by Dr. Thomas Penny, an Elizabethan physician and botanist, who after devoting considerable labour to the compilation also died before its completion. Dr. Mouffet

then purchased the manuscript and organized and illustrated the material, but died without publishing it. Finally, in 1634, nearly a century after it was started by Gesner, it was published by Sir Theodore Mayerne, one of the court physicians of Charles I. In spite of the deficiencies of this work it is considered valuable as a summary of ancient knowledge on the insects.

Not until the latter part of the seventeenth century did students begin to make original observations on insects, instead of copying from ancient authorities, but from then on great advances were made. At this time the Italian, Francesco Redi, completely disproved experimentally the old and widely held belief in spontaneous generation, and Malpighi of Italy, and Swammerdam and Leeuwenhoeck of Holland, did original work on the anatomy of insects. During this period the workers in entomology and the papers they published became increasingly numerous in England, as well as on the continent. An outstanding worker of this period was the Englishman John Ray, whose work in systematizing entomological knowledge considerably influenced Linnaeus. Two important works by Ray published at the beginning of the eighteenth century are Methodus Insectorum and Historia Insectorum.

One of the foremost entomologists of the early eighteenth century was Réaumur, who published many studies in insect anatomy and physiology, and original observations on the life-histories and habits of insects, which are valuable to this

Mention should be made of the leading role played by the Royal Society of London from the latter part of the seventeenth century onward, in publishing important papers relating to insects. The Entomological Society of London, which is one of the world's oldest societies for the study of insects, was formed in the early part of the nineteenth century. During the seventeenth century the first private and public collections of insects were established in England. An important one was acquired by the British Museum during the latter half of the eighteenth century.

In 1758, the Swedish naturalist Linnaeus published the Tenth Edition of the Systema Naturae in which the binomial system of nomenclature was adopted. This work greatly facilitated the classification of insects and made accurate identification generally possible. An almost virgin field of interesting study and discovery was opened to students by the inspired work of Linnaeus. The number of workers in entomology rapidly increased both in England and abroad, and many popular works on insects were printed and helped to provide a good foundation for a rapid expansion of the science. The work of collecting and describing new species was taken up with enthusiasm, especially by the professional classes, notably teachers, physicians and clergymen. These workers largely concerned themselves with the adult forms, but the description and classification of species and the establishment of named insect collections was invaluable, and an essential preliminary

to the successful development of economic or applied entomology which has to do with the life-histories, biology and control of insect pests.

Two outstanding workers in general entomology in England during the first part of the nineteenth century were Kirby and Spence (31), whose informative and entertaining "Introduction to Entomology" went through seven editions over a period of forty years and has been an inspiration to all interested in insect life. Since the beginning of the nineteenth century the number of books and articles that have been published in the various fields of entomology is enormous. Two of the English works were referred to by Dr. L.O. Howard (29) as epoch making, because they summarize the status of entomology at the time they were written. The first is Prof. J.O. Westwood's "Introduction to the Modern Classification of Insects", published in London in two volumes in 1839 and 1840, and the second, Dr. David Sharp's work on entomology published in 1895 and 1899, as volumes 5 and 6 of "The Cambridge Natural History".

According to Howard, very little was published in the field of economic entomology, with the exception of a well illustrated standard work by John Curtis, entitled, "Farm Insects", which appeared in 1860. Since that time, however, great strides have been made, and England has given world leadership in the development and encouragement of entomological research. Two publications of importance to entomologists

everywhere, issued by the Imperial Institute of Entomology in London, are the Review of Applied Entomology, which consists of abstracts or reviews of literature on entomology published throughout the world, and the Zoological Record. The Bulletin of Entomological Research and the Annals of Applied Biology also contain much of interest regarding insects and their control.

Today the average high school student is in a position to know more real facts about insects than even the wisest of the ancients. On the other hand, as will have been noted from the foregoing, there was very little accurate information about insects to be found in printed form in the England of Chaucer, Spenser and Shakespeare. Not until Milton's time did Mouffet's work appear and much of that was fallacious. Actually, popular knowledge of insects based on careful observation and experiment is largely a product of the past two centuries, and especially of the last 150 years. If this fact is borne in mind when reading the following chapters, the insect allusions, especially of our earlier writers, will be seen in their proper perspective, and will be evaluated more fairly. This will also ensure a fuller appreciation of the frequent accuracy of their observations, and a greater tolerance towards such misconceptions as may occasionally appear.

CHAPTER II

Some Misconceptions, Superstitions and Beliefs Concerning Insects Revealed in English Poetry and Drama.

In this chapter are brought together, in brief form, some of the more common misconceptions, superstitions and beliefs relating to insects found in poetry and drama. They are discussed more fully under the various orders in the chapters that follow.

For many years there was popular confusion between the grasshopper and the cicada, in spite of the fact that the two insects belong to different orders and are quite dissimilar in life-histories and habits, and the former is common and the latter scarce in England. This error was the result of applying entomological knowledge learned from classical Greek sources instead of depending on original observation, for naturally, there is a considerable difference between the insect fauna of north temperate England and that of the warmer, sunnier lands about the Mediterranean. The Greeks referred to the Tettix which represents the abundant shrill cicada of their region. English students of the classics were not familiar with the cicada and thought that the grasshopper was meant. Thus it came about that Ben Jonson could write of grasshoppers "screaming" when held by the wings, although this is possible

only to the cicadas. The cicada has a piercing beak and was thought to feed on dew, but actually sups on plant juices. This quality, too, was assigned to the grasshopper, although that insect feeds on vegetation by biting and chewing it. Even the "song" of the grasshopper was greatly exaggerated because of this misinterpretation, and the well known fable of Aesop about the ant and the improvident grasshopper properly concerns the ant and the cicada. Lovelace, Jonson, Cowley and Hood are among the poets who confused the two insects. A more complete discussion of this subject will be found in Chapters III and V.

Popular interest has always been keen in the social insects (see Chapter VIII), especially the honey-making bees, but it is only in comparatively recent years that their organization and activities have been properly understood. An old and apparently popular belief was that honey bees may hive in the carcasses of animals. This may have originated from the Biblical story of Samson finding a swarm of bees and honey in the carcass of a lion. The ancients also thought that the bee was produced in the dead bodies of a sheep or an ox. Shakespeare wrote that it is seldom that the bee leaves "her comb in the dead carrion", and Kipling wrote a poem describing what happened when a farmer tried to produce bees from a dead bull in accordance with the ancient formula. Whatever was wrong with his method, the farmer succeeded only in raising a host of maggots and

buzzing flies. Ben Jonson alluded to the supposed spontaneous generation of various insects in carcasses and dung in The Alchemist (II.3.172). This was when the alchemist, Subtle, in trying to convince the suspicious Surly of the feasibility of transmuting base metals into gold, stated:

> "Beside, who doth not see in practice
> Art can beget bees, hornets, beetles, wasps,
> Out of the carcasses and dung of creatures;
> Yea, scorpions of an herb, being rightly placed?
> And these are living creatures, far more perfect
> And excellent than metals."

According to Kirby and Spence (31, p.35), Sir Theodore Mayerne, the editor of Mouffet's work on insects referred to in the previous chapter, drew the inference "that if animals are transmuted so may metals" be.

Another popular misconception in times past about bees was that the colony is ruled over by a king or male leader. This idea is expressed in a number of Shakespeare's plays. Actually, the hive has no king, emperor, or other form of individual leader, but is managed entirely by the workers on a division of labour basis. The queen is not a ruling queen, but a fertile egg-laying female, whose prime duty is to reproduce continuously and abundantly. When she fails in that function she is slain and replaced by a young rival.

John Gay and Thomas Parnell reveal in their poetry that they believed that the worker bees were males, whereas actually they are undeveloped females. The Elizabethan poets were also misinformed regarding the bees' honey and wax.

Milton wrote of "the bee with the honey'd thigh"; Herrick, Cary, and Parnell described her "honey-bag". What the bees collect from the flowers is nectar, not honey. It matures into honey after being stored for some time in the wax cells of the honeycomb. Furthermore, it is carried to the hive in the insect's crop, not in an external "bag". The wax was supposed to be collected in the field and carried to the hive on the bees' thighs. Parnell mentioned this as also did Shakespeare, who referred to bees with their "thighs pack'd with wax". In fact, the wax is produced within the hive as a secretion of hypodermal glands in the bee's abdomen. The erroneous beliefs about the honey bag and the wax, and the male being armed with a sting are repeated in the case of the bumble bees. The sting consists of the modified ovipositor and is confined to the worker females and the queens.

Marlowe, in the sixteenth century, and Rogers two-hundred years later, expressed the thought that perfume guides the bees to the flowers and, also, according to the latter, enables them to find their way home to the hive. However, the modern understanding is that sight and memory, not smell, serve to guide the bees in their wanderings.

Edmund Spenser and John Day both credited the male wasp with bearing a sting. The latter was so misinformed concerning the true nature of the sting, which is the female ovipositor, that he wrote of a strange hornet having "a double

speare coucht in his front". For a more complete discussion of the Hymenoptera the reader is referred to Chapter VIII.

The poets seem to have made fewer mistakes about the butterflies and moths (see Chapter VI), perhaps because they were able to examine these decorative and harmless creatures more closely. However, even modern poets sometimes make errors in the field of biology; so we find Kipling describing "whorls and clots of dull grey" on cabbage leaves in the garden, as the eggs of the cabbage butterfly, whereas any careful observer would know that what he saw was the excrement of the caterpillars.

Early in the Christian era, the Roman Pliny recorded that clothes placed upon a coffin are safe from moths, and during the Middle Ages, it was believed that clothes wrapped in a lion's skin would be free from damage. Neither of these ancient superstitions would bear scientific investigation.

People used to fear the death's head moth as a messenger of pestilence and death, merely because there is a fancied resemblance to a skull and crossbones on its back, and it is able to make a plaintive squeaking sound. Some also thought that the night-flying moths which make for the candle are inhabited by the souls of the dead and are in search of light.

Erasmus Darwin, who, as the grandfather of the celebrated Charles Darwin, should have known better, wrote a

poem in which he describes how the silkworm moth flits from flower to flower sipping honey and seeking his mate "on silver wings". Actually, the silkworm moth has lost the power to fly and takes little or no nourishment.

Carlyle expressed in poetry his thought that the parent ground beetle hunts food for its helpless young. The truth is that the young or grubs of the beetle are far from helpless and waylay and feed upon other insect life, and on that account are important in biological control.

The so-called death-watch (see Chapter VII) used to inspire superstitious terror when it was heard ticking in the woodwork, for it was supposed to foretell the death of a member of the family within a year. Several poets referred to this belief. Actually, the "death-watch" is a beetle that bores into wood and is quite harmless to humans, and incapable of foretelling their deaths.

Many of the poets, among them Chaucer, Shakespeare, Oldys, Burns, and Wolcot, revealed in their poetry that they thought the common house fly harmless (see Chapter IX), whereas, in fact, this is the most important disease-carrying insect in temperate climates. In this error, the poets undoubtedly reflected a popular attitude that is still not wholly dissipated. Spenser wrote of a male mosquito biting a person, but actually only the females bite. However, nearly three centuries elapsed

before this fact became generally known. The biology of the bot flies, and even the relation between the bots in horses' stomachs and the bot flies on the wing, was unknown in Shakespeare's time, and for long afterwards. Evidently, judging from an item in one of Shakespeare's plays the presence of bots in a horse was blamed on poor food.

The bacterial nature of plague or "black death", and the fact that it is flea-borne has been known for less than fifty years (see Chapter X). At one time, it was believed to be caused by the exhalations from decaying organic matter, as expressed by Shakespeare in King Henry V. Two-hundred years ago, James Thomson included in his poem The Seasons the belief probably commonly held at that time, that plague originated from putrefying heaps of locusts in Egypt, or from poisoned forests in Ethiopia.

The silk of the spider is produced from silk glands in the animal's cephalo-thorax, but Shakespeare and Dryden (see Chapter XII) thought it was spun from the abdomen, the former mentioning the "womb", and the latter the "entrails". It used to be believed, and may be to this day, that spiders are dangerous creatures. Actually, very few of them are capable of harming humans, especially in temperate climates. Spiders used to be considered of value in curing malaria.

Many species of insects were featured in medical practice in medieval times, and as recently as less than two centuries ago. Kirby and Spence (31, p.178) state that among

"scores of infallible panaceas" the following were recommended, namely: "the wood-louse as a solvent and aperient; powder of silkworm for vertigo and convulsions; millipedes against the jaundice; earwigs to strengthen the nerves; powder scorpion for the stone and gravel; fly-water for disorders in the eyes; and the tick for erysipelas; five gnats as an excellent purge; wasps as diuretics; lady-birds for the colic and measles; the cockchafer for the bite of a mad dog and the plague; and ants and their acid... as incomparable against leprosy and deafness, as strengthening the memory and giving vigour and animation to the whole bodily frame".

One could continue writing at length on this interesting subject, but space is limited and it is necessary to proceed to a consideration of the various insects alluded to in the poetry and drama of England, which is the main purpose of this article.

CHAPTER III

Order Orthoptera: The Grasshoppers, Katydids and Crickets

The Orthoptera are, in general, rather large insects, not particularly good fliers, but with well developed powers of running and leaping. Some of the species belonging to the order are very numerous and widely distributed, and are important economically because of the damage they do to plant life in satisfying their truly enormous appetites. Prominent among these are the short-horned grasshoppers (family Acrididae) and the crickets (family Gryllidae). This order, too, includes several of the best known singers or instrumentalists in the insect world, the most accomplished of which are the long-horned grasshoppers or katydids of the family Tettigoniidae.

Family Acrididae: The Short-horned Grasshoppers.

The species of grasshoppers which do most damage to crops belong to the family Acrididae, or short-horned grasshoppers, so-called because their antennae are much shorter than those of species in related families. They are also commonly referred to as locusts, especially when they assume the swarming or migrating habit. There are a number of eloquent references to locusts in the Bible, the earliest being in Exodus (X), wherein is described the plague of locusts inflicted upon Egypt

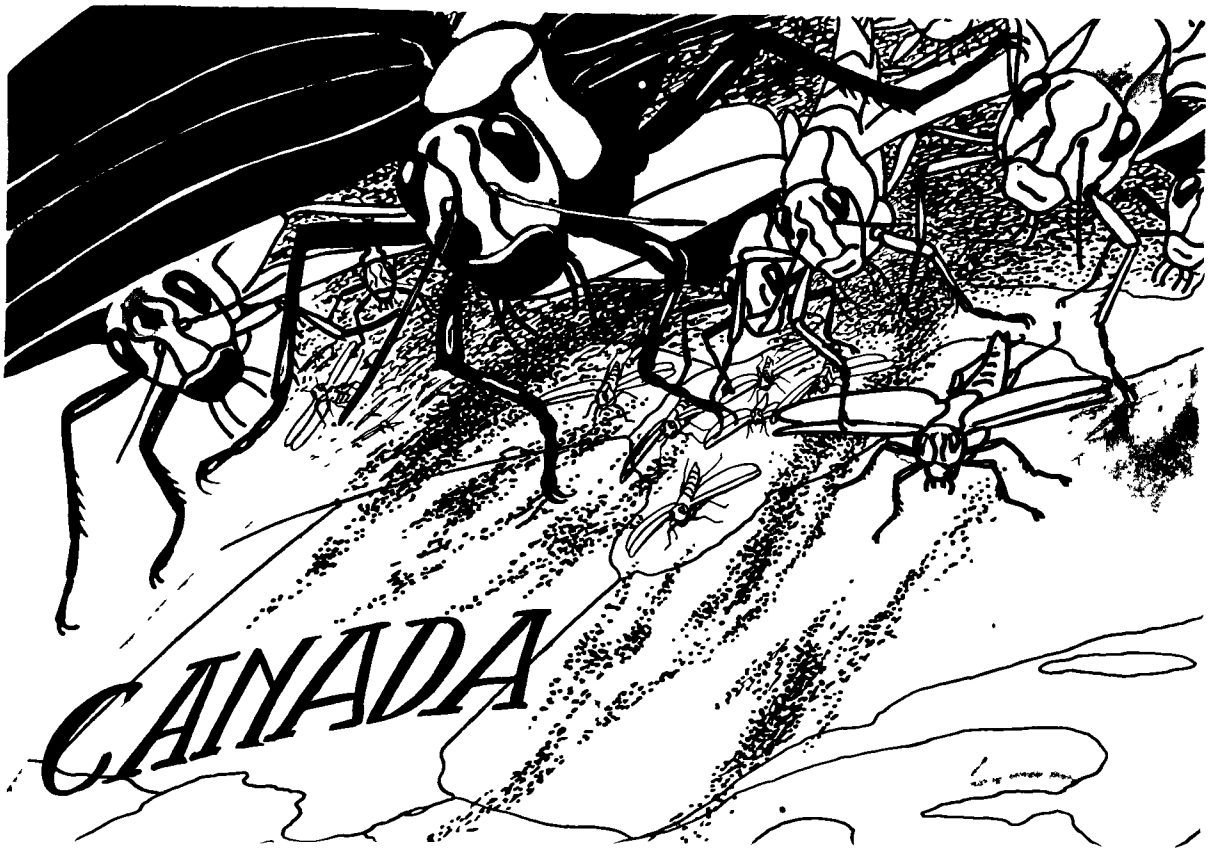


PLATE I - A plague of locusts. An artist's conception of migrating grasshoppers in Western Canada. Drawing by Hennessey (after Gibson).

to punish Pharaoh for his oppression of the Israelites. This account of a locust outbreak is given at some length here because of its vividness and general accuracy. Moses and Aaron brought God's message to Pharaoh to "let my people go" or:

"Else if thou refuse... tomorrow will I bring the locusts unto thy coast: And they shall cover the face of the earth, that one cannot be able to see the earth: And they shall eat the residue of that which is escaped, which remaineth unto you from the hail, and shall eat every tree which groweth for you out of the field: And they shall fill thy houses, and the houses of all thy servants, and the houses of all the Egyptians; which neither thy fathers, nor thy fathers' fathers have seen, since the day that they were upon the earth unto this day.... And the Lord saith unto Moses, Stretch out thy hand over the land of Egypt, for the locusts, that they may come upon the land of Egypt, and eat every herb of the land.... And Moses stretched forth his rod... and when it was morning the east wind brought the locusts. And the locusts went up over all the land of Egypt, and rested in all the coasts of Egypt: very grievous were they; before them there were no such locusts as they, neither after them shall be such. For they covered the face of the whole earth, so that the land was darkened; and they did eat every herb of the land, and all the fruit of the trees... and there remained not any green thing.... And the Lord turned a mighty strong west wind, which took away

the locusts, and cast them into the Red Sea; there remained not one locust in all the coasts of Egypt."

The species involved in the outbreak thus graphically described was believed by Imms (30, p.248) to have probably been the migratory locust, Schistocerca gregaria which is found in northern Africa, Persia, Afghanistan and northern India. Outbreaks of this and other species have occurred periodically throughout the centuries, causing immense damage and privation. In 1925, there was a great outbreak of this locust in British territory in North Africa which lasted for several years, and caused damage estimated at more than thirty millions of dollars.

Milton used the plague of locusts described in Exodus to illustrate in Paradise Lost (I.339-346) the tremendous number of "bad angels... hovering... under the cope of Hell":

> "As when the potent rod of Amram's son, in Egypt's evil day
> Waved round the coast, up called a pitchy cloud
> Of locusts, warping on the eastern wind,
> That o'er the realm of impious Pharaoh hung
> Like night, and darkened all the land of Nile:
> So numberless were those bad angels seen
> Hovering on wing under the cope of Hell".

In Book 12 (185) he refers directly to the plagues of Egypt:

> "Hail mixed with fire must rend the Egyptian sky,
> And wheel on the earth, devouring where it rolls;
> What it devours not, herb, or fruit, or grain,
> A darksome cloud of locusts swarming down
> Must eat, and on the ground leave nothing green;".

A very fine account of the approach of a swarm of locusts was given in somewhat metaphorical language by the

prophet Joel (Joel, 2.2-10;20):

"A day of darkness and of gloominess, a day of clouds and of thick darkness, as the morning spread upon the mountains; a great people and a strong; there hath not been ever the like, neither shall be any more after it, even to the years of many generations. A fire devoureth before them, and behind them a flame burneth: the land is as the garden of Eden before them, and behind them a desolate wilderness; yea, and nothing shall escape them.... Like the noise of chariots on the tops of mountains shall they leap, like the noise of a flame of fire that devoureth the stubble, as a strong people set in battle array. Before their face the people shall be much pained: All faces shall gather darkness. They shall run like mighty men; they shall climb the wall like men of war; and they shall march every one on his ways, and they shall not break their ranks: neither shall one thrust another; they shall walk every one in his path.... They shall run to and fro in the city; they shall run upon the wall; they shall climb up upon the houses; they shall enter in at the windows like a thief. The earth shall quake before them, the heavens shall tremble: the sun and the moon shall be dark, and the stars shall withdraw their shining:".

Authorities agree that this is a remarkably accurate description of an army of locusts on the move. In his Thalaba (L.169), the poet Southey also deals with this subject and

graphically describes the noise of the grasshoppers in flight, which elsewhere has been likened to the sound of flame driven before the wind:

> "Onward they came, a dark continuous cloud
> Of congregated myriads numberless,
> The rushing of whose wings was as the sound
> Of a broad river headlong in its course
> Plunged from a mountain summit, or the roar
> Of a wild ocean in the autumn storm,
> Shattering its billows on a shore of rocks!"

It is only in comparatively recent years that the possibility of combating or forestalling locust outbreaks has received serious study. According to Burr (9, p.270) there were attempts in Pliny's day to control the locusts. In Cyrenaica, strict regulations were enforced for the collecting of the eggs and other life-stages of the locusts towards this end. Modern scientific research and organization is now being applied to the problem, and with the co-operation of the governments and peoples concerned a solution should be found that will relieve a large section of humanity from this intermittent scourge. It is possible, in view of the tremendous areas affected, that such a solution will involve locating and studying the original breeding places of the insects, and with adequate organization and financial support taking steps to destroy incipient outbreaks at their source.

The ancient practice of eating locusts, which still persists, may be considered to some extent a control measure, as well as a means of adding proteins to the diet. The

Israelites were permitted to eat locusts under Mosaic law. In Leviticus (XI.21-22) the Authorized Version presents Moses' instructions to the children of Israel as follows:

"... these of them may ye eat: the locust after its kind, and the bald locust after its kind, and the cricket after its kind, and the grasshopper after its kind."

Burr consulted several leading authorities as to the precise meaning of the original Hebrew words denoting the insects, and although there was some difference of opinion, came to the conclusion that not four different kinds of insects were meant, but the various stages in the development of the locust from the youngest nymph to the migratory form.

Many other peoples of Asia and Africa besides the Israelites consider locusts as a legitimate and enjoyable form of nourishment. It may have been one of the migratory species common to Morocco and customarily used for food that Shakespeare referred to in "Othello" (I.3), when he had Iago say to Roderigo: "Fill thy purse with money, the food that to him now is as luscious as locusts".

One method of preparing these locusts for the table is to throw them into boiling, salty water, afterwards removing the head and appendages. They may then be broiled, stewed or fried in butter, when they are said to resemble shrimps or prawns.

While on the subject of locust control it is of interest to recall early efforts to deal with grasshopper

outbreaks by methods of ecclesiastical censure. In Purchas's Pilgrimes (II,1047), published in London in 1625, there is, according to Phipson (46, p.395), an account by a Portugese priest named Sir Francis Alvarez, of how he excommunicated the locusts in Ethiopia in the year 1560:

"The number of these creatures", he wrote, "is as great as it is incredible, and with their multitude they cover the earth and fill the ayre in such wise that it is an hard matter to be able to see the sun.... These vermine are as great as a great grasshopper, and have yellow wings.... We assembled the people of the towne, and all the priests, and taking a consecrated stone and a crosse, all we Portugals sung the Letanie. I caused them to take a quantity of locusts, and make of (over) them a conjuration, which I carried with me in writing, which I had made the night before, requiring them, charging them, and excommunicating them, willing them within three houres space to begin to depart toward the sea, or toward the land of the Moores, or towards the desert mountains, and to let the Christians alone: and if they obeyed me not, I called and adjured the fowles of the heaven, the beasts of the field, and all the tempests, to scatter, destroy, and consume their bodies. And for this purpose I tooke a quantity of these locusts, and made this admonition to them which were present, in the name of themselves, and of those which were absent: and so I let them goe, and gave them libertie.... In

the meanwhile, arose a great storm and thunder towards the sea, which lasted three hours, with an exceeding great shower and tempest, which filled all the rivers, and when the water ceased, it was a dreadful thing to behold the dead locusts, which we measured to be above two fathoms high upon the bankes of the rivers in such wise, that on the next morning, there was not one of them found alive upon the ground."

Another interesting item of this sort, recorded from Purchas's work by Weiss (63), which throws further light on the credulity and customs of the time, reads as follows:

"In the yeere 1603, at Fremona, great misery happened by Grasse-hoppers, from which Paez freed the Catholikes, by Letanies and sprinkling the Fields with Holy-water; when as the Fields of Heretikes, severed only by a Ditch were spoyled by them. Yea, a Heretike using this sacred sprinkling, preserved his corne, which to a Catholike neglecting in one Field, was lost, and preserved in another by that conjured aspersion (so neere of kinne are these Locusts to the devill, which is said to hate Holy-water)."

The true migratory locusts do not occur in the British Isles, but a dozen other species of short-horned grasshoppers are represented there, certain of which have attracted the attention of the poets from time to time. A score or more of English poets have written of the grasshopper, but most of them seem to have been more impressed with its

supposedly happy life and gay song than with its destructive possibilities. An exception was Moore, who in The Periwinkles and the Locusts wrote:

"Of all the beasts that ever were born,
Your locust most delights in corn;
And though his body be but small,
To fatten him takes the devil and all!"

Nicholas Udall, in Ralph Royster Doyster, the first English comedy, used the grasshopper to point a moral, and doubtless drew his inspiration for so doing from classical sources.

"As long liveth the mery man (they say),
As doth the sory man, and longer by a day:
Yet the grasshopper for all his sommer piping
Sterveth in winter wyth hungrie gripyng."

Actually, most species of grasshoppers die in the autumn after depositing their eggs in the soil to carry the species through the winter. Keats, in his poem On the Grasshopper and the Cricket, illustrates the true poet's attitude towards the grasshopper, an attitude often based on a misunderstanding of the insect's activities. It reads:

"The poetry of earth is never dead;
When all the birds are faint with the hot sun,
And hide in cooling trees, a voice will run
From hedge to hedge about the new-mown mead;
That is the Grasshopper's—he takes the lead
In summer luxury,—he has never done
With his delights; for when tired out with fun
He rests at ease beneath some pleasant weed."

Actually, the grasshopper lives dangerously from the egg-pod to the grave. He is continually in stern competition with his fellows for food, and is subject to the attacks of

numerous enemies, including birds, parasitic flies, predacious beetles, roundworms, and fungous and bacterial diseases, not to mention man. In short, his life is not an enviable one, and although he may swing "upon the waving ear of some well-filled oaten beard", he is not "drunk every night with a delicious tear" dropped from heaven, as suggested by Richard Lovelace in the seventeenth century.

The poets have frequently mentioned the grasshopper's song, usually in words of praise, as in Shelley's Invocation to Misery (V):

"On the fresh grass newly mown,
Where the grasshopper doth sing
Merrily—one joyous thing
In a world of sorrowing!"

In truth, few of the common short-horned grasshoppers are really musical. The noises they make are usually subdued stridulations produced by scraping a row of tiny teeth on the inside of the hind thighs against a hardened vein on each of the closed front wings. Only the males do this; the females are noiseless. The highest development in musical attainment among the insects has been reached by certain of the related long-horned grasshoppers, or katydids, which sing by night as well as by day. The crickets, also excell the common grasshoppers, and so do the cicadas which belong to an entirely different order, the Hemiptera, which will be discussed later. Ben Jonson, thanks probably to the misconceptions of his classical authorities, confuses the grasshopper with the

cicada in his play The Poetaster (V), when he refers to angry wasps or hornets which buzz madly about his nostrils "and like so many screaming grasshoppers held by the wings, fill every ear with noise". A grasshopper when held by the wings cannot buzz, but a cicada, which has a drum-like tympanum in its abdomen, can.

Thomas Hood was more or less right when he wrote of:

"The tender grasshopper...
That all the summer, with a tuneful wing,
Makes merry chirrupings in its grassy nest,"

but he, too, missed the mark when he added that the insect was "inspirited with dew to leap and sing". This, also, is the result of confusing the grasshopper with the cicada, the latter of which has beak-like mouthparts and was believed by the ancients to subsist on dew, whereas the grasshopper has chewing mouthparts and tears and masticates its food.

Pope, in The Iliad of Homer (III,199), likened senile old men to grasshoppers:

"Chiefs who no more in bloody fights engage,
But wise through time, and narrative with age,
In summer days like grasshoppers rejoice,—
A bloodless race, that send a feeble voice."

Actually, like other insects, grasshoppers are not bloodless, although their blood lacks red corpuscles, and is colourless or pale yellow or greenish. According to mythology, the grasshopper represents Tithonius, who received the gift of eternal life from the fair Eos, without the equally desirable gift of eternal youth. Tennyson refutes this libel on the

grasshopper in the following lines:

"No Tithon thou as poets feign
(Shame fall on 'em, they are deaf and blind),
But an insect lithe and strong,
Bowing the seeded summerflowers.
Prove their falsehood and thy quarrel,
  Vaulting on thine airy feet.
Clap thy shielded sides and carol,
  Carol clearly, chirrup sweet
Thou art a mailed warrior in youth and
  Strength complete;".

Family Tettigoniidae: The Long-horned Grasshoppers or Katydids.

In Caliban Upon Setebos, Robert Browning put in Caliban's head the thought that if he had wings he could:

"Fly to yon rock-top, nip me off the horns
Of grigs high up that make the merry din
Saucy through their veined wings,".

The "grigs" referred to may have been long-horned grasshoppers or katydids. The character which most obviously distinguishes these insects from the ordinary field grasshoppers is the much greater length of the feelers or antennae. Further, they are usually bright green in colour and commonly live in shrubs and trees.

The katydids are among the most accomplished of insect musicians, especially the true katydid, Pterophylla camellifolia, which is well known to the people of the United States but is not found in Europe, although other species occur there. Snodgrass (52) published a very charming and instructive paper on these and other musicians of the insect world. The musical instrument of the katydids is situated on

the bases of the front wings of the adult males: the females, of course, are silent. This consists, in the left wing, of a thin membrane, termed the tympanum, strengthened by veins, one of which is thickened and serrated like a file. The chief difference in the right wing is that the basal angle bears a stiff ridge. The wings of the katydids are always folded with the left overlapping the right so that the file lies above the ridge. Thus, when the wings are moved sideways the file scrapes on the ridge and serves as a musical instrument the tone and volume probably depending on the vibration of the tympana.

The long-horned grasshoppers are nocturnal, the males singing at night instead of during the daytime, as is the habit of the short-horned species. It was doubtless to one of the former that Byron referred in the following lines from Childe Harold (814):

> "It is the hush of night... on the ear
> Drops the light drip of the suspended oar,
> Or chirps the grasshopper one goodnight carol more.
> He is an evening reveller, who makes
> His life an infancy and sings his fill."

An interesting fact about these insects is that the organs which are supposed to be their "ears" consist of two vertical slits in each front tibia. In the short-horned grasshoppers on the other hand, the "ears" consist of a tympanum stretched across a cavity on each side of the first segment of the abdomen.

Buckton (8) records that in northern Italy the peasants are fond of the katydid and believe that it confers on them wisdom and culture. The species concerned is a beautiful insect with leaf-like wings, which they call the "Cavelletta". When a mother finds a Cavelletta in the room of a sleeping child she catches it and gently ties it by one leg to the bed-post by means of a long thread, and intones verses, translated by C.G. Leland as follows:

"O Katydid, as good as fair,
Who brings good fortune everywhere;
Since now into this house you've come,
O bring good fortune to my home,
Unto me and everyone,
But most of all unto my son!
Bring it unto me, I pray!
Do not take the least away.

In life you were a lady, full
Of talent, good and beautiful;
Let me pray, as this is true,
You'll give my child some talent too;
And when you fly from East to West
May you in turn be truly blest.
For though an insect form you wear,
You're still a spirit good and fair."

Nine species of these long-horned grasshoppers occur in the British Isles. The largest, Phasgonura viridissima, which has a strident song, is distributed over the southern part of England.

Family Gryllidae: The Crickets.

The cricket family is closely related to the family of long-horned grasshoppers already discussed. They differ from the latter chiefly in having three, instead of four,

joints in their tarsi (feet), and in the position of the upper wings, when at rest, which instead of sloping obliquely, lie flat and have the outer edges turned down over the sides of the body. The stridulating instruments and the "ears" of the cricket are similar in location and function to those described for the katydid.

The cricket is featured in English poetry largely because its chirruping is popularly associated with the comforts of hearth and home. This is clearly indicated in Milton's well-known lines in Il Penseroso:

"Where glowing embers in the room
Teach light to counterfeit a gloom;
Far from all resort of mirth
Save the cricket on the hearth,
Or the bellman's drowsy charm,
To bless the doors from nightly harm:"

And also in Tennyson's Death of the Old Year:

"The shadows flicker to and fro:
The cricket chirps: the lights burn low:
'Tis nearly twelve o'clock."

The species concerned here is the favourite cricket of English poets, namely, the pale brown or straw-coloured house cricket, Gryllus domesticus L., which is widespread in Europe and is now established and spreading in North America. This species likes warm situations, such as cracks and crevices in walls and brickwork close to fireplaces, as noticed by Oliver Goldsmith in the Vicar of Wakefield:

"The cricket chirrups on the hearth;
The crackling fagot flies.";

and chimneys and ovens, as recorded by Shakespeare in Pericles (Act III):

"... crickets sing at the oven's mouth,
Aye the blither for their drouth;"

and for this reason they often become numerous in bakeries, kitchens and basements.

The association of the house cricket with heat and dryness reminds humans of the discomforts of thirst and is responsible for the common saying, "I am as dry as a cricket". Tennyson used this expression in the Voyage of Maeldune, line 50 which reads: "... each was as dry as a cricket with thirst in the middle day heat".

There is considerable difference of opinion as to the quality of the cricket's song. To Keats it was full of poetic significance, and during the winter cold reminded him of the grasshopper in the summer hills, as expressed in his sonnet on The Grasshopper and the Cricket:

"The poetry of earth is ceasing never:
On a lone winter evening, when the frost
Has wrought a silence, from the stove there shrills
The Cricket's song, in warmth increasing ever,
And seems, to one in drowsiness half lost,
The Grasshopper's among some grassy hills."

To others the cricket's stridulations are a cheerful sound. In Shakespeare's Part I, Henry IV (II.4), at the Boar's Head Tavern, Poins answers Prince Hal's query, "Shall we be merry?" by saying, "As merry as crickets". Cowper refers to the house cricket as: "Little inmate, full of mirth, always harbinger of good, paying for thy warm retreat with a song

On the other hand, many people find the nocturnal chirruping of the house cricket very monotonous and annoying, and their exasperation is frequently increased by their inability to locate the whereabouts of the little instrumentalis who is very nimble and elusive. Surprisingly, perhaps, the poets were immune to such reactions: in any event they did not record them. Shakespeare and Browning, however, employed the cricket to create a tense or uncanny atmosphere. In MacBeth (II.2), after murdering King Duncan, MacBeth asked Lady MacBeth if she heard aught and she replied: "I heard the owl's scream and the cricket's cry". Browning, in A Toccata of Galuppi's (XII), likened Galuppi's old Venetian music to "a ghostly cricke

"In you come with your cold music till I creep
thro' every nerve.
Yes, you, like a ghostly cricket, creaking
where a house was burned:".

That the cricket's song is largely a nocturnal one was recognized by Shakespeare, in Cymbeline (II.2). Iachimo looks into the room where Imogen lies sleeping and says: "The crickets sing, and man's o'er-labour'd sense repairs itself by rest". Crickets, of course, have a sense of hearing, as one quickly learns if one attempts to find their hiding places by tracking down the sound. Shakespeare was doubtless aware of this, although it is improbable he knew that the cricket's "ears" are located in the tibiae or shins of the front legs. In Winter's Tale (II.1), when Hermione dares young Mamillius to fright her with a tale of goblins, he says: "I will tell it

softly; yon crickets shall not hear me." Browning, too, in Saul (VI), tells of David entering King Saul's tent and playing on his harp a "tune what makes the crickets elate till for boldness they fight one another;".

Snodgrass (19) records keeping two vigorous males of a related species in a cage with several females. The two males showed great rivalry in their stridulations, each trying desperately to out-fiddle the other. They even jostled and threatened each other with open jaws, but did no actual bodily harm. Crickets are omnivorous, however, and will readily devour the corpses of their fellows, and doubtless also the still living bodies of the feeble or dying.

In warm weather, house crickets frequently establish themselves outdoors where there is a good food supply, such as in refuse dumps. They may also be found in more attractive places as, for instance, in the garden near Würzburg described by Browning's character Paracelsus in the poem of that name, as:

> "... this kingdom, limited
> Alone by one old populous green wall
> Tenanted by the ever-busy flies,
> Gray crickets and shy lizards and quick spiders,
>
> . . . . . .
>
> "Fancy the crickets, each one in his house,
> Looking out, wondering at the world."

Herrick, Shelley and Tennyson also referred in their poems to a different though related species. This is the common black field cricket of the British Isles, Gryllus campestris. Like its domesticated relative it is fond of

warmth but, nevertheless, may be heard chirruping at all hours and in all weathers during summer and autumn. This was the species that served in the insect orchestra which entertained the fairy elves at King Oberon's feast, as described by Herrick in his Hesperides:

> "... the chirring grasshopper,
> The merry cricket, puling fly,
> The piping gnat for minstrelsy:".

It was probably also the species that Shelley meant in The Boat on the Serchio, when he said that "the crickets were still in the meadow and hill" when day awakened. It was certainly this species that was referred to in Tennyson's Lancelot and Elaine by Lancelot, when he said reproachfully to Guinevere:

> "My Queen, that summer, when ye loved me first,
> Then of the crowd ye took no more account
> Than of the myriad cricket of the mead,
> When its own voice clings to each blade of grass,
> And every voice is nothing."

CHAPTER IV

Order Anoplura: The Lice

There are two different kinds of lice: the biting lice, which belong to another order, the Mallophaga, and are commonly called bird lice because of their prevalence on birds; and the sucking lice, or Anoplura, which spend their entire life-cycle as external parasites of mammals. There are at least 150 species in this order, but the poets appear to have referred to only two, both of which live on humans, and one of which carries disease and thereby is one of the worst insect scourges of mankind. The latter, known among entomologists as Pediculus humanus L., occurs in two varieties or races, designated according to where they thrive as corporis, the body louse, which is the prime offender in spreading disease, and capitis, the head louse. The other species, the pubic or crab louse, Phthirus pubis Leach, although a loathsome parasite, is less common and much less of a menace to health than the body louse, and has received only slight mention in English poetry.

To most people the louse would hardly appeal as a fit subject for poetry, and this opinion was probably shared by most of the poets, for in spite of the undoubted prevalence of these tiny bloodthirsty creatures on the persons of Englishmen and other races throughout the centuries, they have not

given the attention to these repulsive insects which their importance deserves. Only Robert Burns, who wrote on many humble subjects, dedicated a whole poem To a Louse. This was written "on seeing one on a lady's bonnet at church", and consists of eight stanzas, of which the following are the first three:

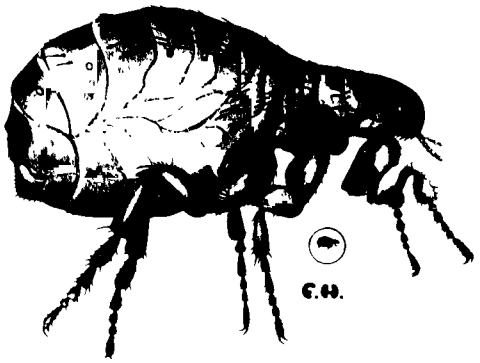
"Ha! whare ye gaun, ye crawlin ferlie!
Your impudence protects you sairly:
I canna say but ye strut rarely,
Owre gauze and lace;
Tho' faith, I fear, ye dine but sparely
On sic a place.

Ye ugly, creepin', blastit wonner,
Detested, shunn'd, by saint and sinner,
How dare ye set your fit upon her,
Sae fine a lady!
Gae somewhere else, and seek your dinner
On some poor body.

Swith, in some beggar's haffet squattle;
There ye may creep, and sprawl, and prattle,
Wi' ither kindred, jumping cattle,
In shoals and nations;
Whare horn nor bane ne'er daur unsettle
Your thick plantations."

Although probably many people brought up in clean, comfortable surroundings, under modern conditions of hygiene and sanitation have never seen a louse, this insect is one of man's most ancient and intimate companions, and is still widespread and prevalent wherever there is overcrowding, a lack of bathing facilities, or carelessness in personal hygiene. There is the following reference to lice in Exodus (VIII.16):

"And the Lord said unto Moses, Say unto Aaron, Stretch out thy rod, and smite the dust of the earth, that it



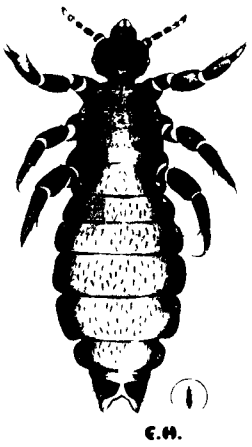


PLATE II - Above: the dog flea. Below: the head louse of humans, both enlarged and natural size (after Gibson and Twinn).

may become lice throughout all the land of Egypt... and Aaron stretched out his hand with his rod, and smote the dust of the earth, and there were lice, upon man, and upon beast; all the dust of the earth became lice throughout all the land of Egypt."

This plague of lice which was visited by God upon Pharaoh and his people for enslaving the Israelites, was mentioned by Milton in Paradise Lost (XII.177) in the following words:

"Frogs, lice, and flies must all his palace fill,
With loathed intrusion, and fill all the land."

There has been some controversy as to whether the original Hebrew name really meant lice, and that fleas or mosquitoes were intended. Certain it is, however, that lice were no strangers to the Egyptians either then or in more recent times.

The Anglo-Saxons of the Middle Ages were assuredly a lousy lot in view of the squalid conditions under which many of them lived. Clothing was seldom changed or washed, and adequate bathing of the body must have been difficult, especially in cold weather. Doubtless, the people huddled together in their hovels at night to keep warm, thus providing ideal conditions for the increase and spread of vermin. Similar conditions existed among soldiers on active service in the World War of 1914-18, and those in the forward areas were almost universally lousy. The Anglo-Saxons called the insects "lus" (singular) and "lys" (plural).

Chaucer does not appear to have mentioned lice, as such, in his works, but in the Pardoner's Tale (858), he referred to "vermyn", and in Troilus and Cresyde (III.381) appear the words, "In wrecchednesse, in filthe, and in vermine"; and in the Romaunt of the Rose (2758) "lyeth in vermyne and in ordure", all of which appear to be references to these insects. As an indication of the prevalence of lice during the Middle Ages, even among the upper classes, it may be mentioned that, according to a contemporary chronicler, as reported by Zinsser (68), the cooling corpse of Thomas à Becket, Archbishop of Canterbury, who was murdered in the Cathedral on Dec. 29, 1170, gave rise through the multifarious garments clothing his body to vermin that "boiled over like water in a simmering cauldron".

Lice were undoubtedly common in sixteenth century London. A hint of this is given in Christopher Marlowe's Tragical History of Doctor Faustus (Sc.4), when Wagner, servant to Faustus, invites the destitute clown to work for them:

> Clown: "... if I were your man I should be full of vermin."
> Wagner: "So thou shalt, whether thou beest with me or no. But, sirrah, leave your jesting, and bind yourself presently unto me for seven years, or I'll turn all the lice about thee into familiars, and they shall tear thee in pieces."
> Clown: "Do you hear sir? You may save that labour: they are too familiar with me already: swowns! they are as bold with my flesh as if they had paid for their meat and drink."

As might be expected, Shakespeare, who recorded so many facts of interest about Elizabethan England, did not omit

to refer to lice. In the Merry Wives of Windsor (I.1) Justice Shallow and his cousin Slender were trying to impress on Sir Hugh Evans, a Welsh parson, the importance of Shallow's family. Slender pointed out that Shallow could sign himself "Armigero", i.e., one who is entitled to bear heraldic arms.

Slender: "All his successors gone before him have done 't, and all his ancestors that come after him may: they may give the dozen white luces in their coat."
Shallow: "It is an old coat."
Evans: "The dozen white louses do become an old coat well; it agrees well, passant: it is a familiar beast to man, and signifies love."

Evans, of course, pretended to misunderstand Slender. Actually, the "luce" is the fleur-de-lis, and the "coat", Shallow's coat of arms. Fyles (25) suggests that the "passage shews that Shakespeare had not forgotten his early escapade, and angry slur upon Sir Thomas Lucy of Charlecote: 'If lousy is Lucy, as some folks miscall it, then Lucy is lousy whatever befall it.'"

In Troilus and Cressida (V.1), Thersites referred to Menelaus, brother of the Grecian General Agamemnon, with profound contempt, when he said: "Ask me not what I would be, if I were not Thersites; for I care not to be the louse of a lazar, so I were not Menelaus". In All's Well That Ends Well (IV.3), Parolles, when asked by his captors whether a certain Captain Dumain was in the camp of the Duke of Florence, replied: "Upon my knowledge, he is and lousy".

Edmund Spenser, who lived for nearly two decades on

the estate of Kilcolman, in Ireland, recorded in his "View of the Present State of Ireland", published in London thirty-four years after his death, that the Irish thought: "Howe handsome it is to lye and sleepe, or to lowze themselves in the sunshine."

To the present day tramps and beggars are notoriously lousy, and there is a great deal of truth in the old Scottish proverb, recorded by John Ray, which states that: "Gie a beggar a bed and he'll repay you with a louse". Thomas Fuller, a royalist clergyman and poet of the early seventeenth century, expressed the same thought in Gnomologia (X) with the words: "A beggar pays a benefit with a louse". Zinsser (68) thought that the prevalence of lice was one reason for shaving the head and wearing a wig in Pepys' day. The latter recorded in his famous Diary the necessity of having his wig "cleansed of its nits", which of course were the eggs of the head louse, which are normally glued firmly to the hairs of the head. Incidentally, Pepys made the following illuminating observation in his Diary on June 6, 1663: "To York House, where the Russian Ambassador do lie; and there I saw his people go up and down lousing themselves".

Butler included lice for satirical purposes in Hudibras (III.1.437). He mentioned both the ordinary "cootie" and the "crab" louse, the latter under the name of morpion which is a word of French origin. The crab or pubic louse, although equally loathsome, is less dangerous to health than

the body louse, as its sedentary habits preclude it from becoming an important disease carrier. It lives on hairy parts of the body, such as the pubic region and the armpits, where it clings to the base of the hairs close to the skin with the heavy claws of its hind legs, and feeds liberally on the blood of its unsuspecting or complaisant victim. The crab louse is not active like the body or head louse, but moves about only sufficiently to take care of essential requirements for the continued existence of the species, such as mating and transferring to new hosts as opportunities provide.

Dr. Robert Hooke who was the first to discover that the tissues of all living organisms are made up of cells, had an insatiable curiosity about living things generally. In 1736, he published in London "A Natural History of Spiders and Other Curious Insects", containing a section on lice which shows that during his day the condition of lousiness was common in all classes of society. He states: "This (the louse) is a creature so officious, that 'twill be known to everyone at one time or other, so busie, and so impudent, that it will be intruding itself in every one's company, and so proud and aspiring withall, that it fears not to trample on the best, and affects nothing so much as a crown; feeds and lives very high and that makes it so saucy, as to pull any one by the ears that comes in its way, and will never be quiet till it has drawn blood". Apparently, as Burns wrote, even "a lord may be a lousy loun, wi' ribbon, star, and a' that".

The louse is sometimes used to depict extreme stingyness. Wodroephe, in Spared Houres (1623) remarked: "He would have flayed a louse for her skin"; and Duffy expressed the same thought in The Coiner (Sc.7), with the words: "Thrifty! Man, she'd skin a louse for his hide"; and so also does W.C. Hazlett in English Proverbs with the remark: "He'd drive a louse a mile for the skin and tallow of 'en".

Malcolm Burr (9) in his instructive and entertaining book, The Insect Legion, repeats a little story to illustrate the fact that the louse was used in polite conversation in Georgian England. The third Lady Holland was annoyed by certain remarks of the witty Theodore Hook, and accordingly she told him that he was not welcome in her house and added: "I do not care three skips of a louse for you". Hook had his revenge shortly afterwards by writing the following:

"Her ladyship said when I went to her house,
She did not regard me three skips of a louse.
I freely forgive what the dear creature said,
For ladies will talk of what runs in their head."

Some language in which the louse is used is not so polite. In fact, it may be positively rude as in Burns' Reply to an Epistle Received from a Taylor, which starts off with:

"What ails ye now, ye lousie bitch,
To thresh my back at sic a pitch?"

In the next stanza he referred to the taylor as a "prick-the-louse, an "jag-the-flae", which terms hardly seem complimentary.

The most important fact about the human louse is that it carries the dreaded typhus fever which has caused the deaths of untold millions. This disease was widespread in Europe for two or three hundred years prior to 1870, after which little was heard of it until the last World War, when outbreaks again flared up with devastating effect in the Balkans, Russia, and other parts of Eastern Europe and the Near East. The true nature of the disease and the method of transmission, however, was not demonstrated until 1909 when the American, Ricketts, who was later himself a martyr to typhus, drew attention to the causal organism (subsequently named Rickettsia prowazeki by da Roche Lima), and the Frenchmen, Nicollé, Conte and Conseil obtained experimental proof in North Africa that the louse transmits it from one person to another.

In view of the method of transmission it is not surprising that typhus has proved most prevalent and deadly where people are crowded together under insanitary conditions such as may occur during periods of war, famine, or other national disaster. Soldiers on active service, improperly cared for prisoners of war, refugees, and the inmates of over-crowded hospitals and gaols are liable to become heavily infested with lice and are, therefore, especially vulnerable to outbreaks of typhus. The disease is spread through the medium of the excreta of infected lice, when this is rubbed or scratched into abrasions of the skin. It may also be carried in minute dust particles in the air to exposed mucous membranes such as

Typhus is discussed here at some length because, although owing to lack of knowledge the poets omitted mention of it in association with lice, it has played a leading role in world events and doubtless has affected life and literature in many ways. The important influence of typhus in world affairs has been described by Hans Zinsser in his entertaining and illuminating book "Rats, Lice and History". Apparently, epidemic typhus was absent from Europe before the fifteenth century, but subsequently it became well established on the continent, and by the middle of the sixteenth century invaded the British Isles where the lousy people crowded in their dirty towns and villages provided ideal conditions for its spread.

The disgracefully overcrowded and filthy gaols where the prisoners were "lodged like hogs and fed like dogs" became hotbeds of the disease, which was then called "gaol fever". It took a grim toll of the inmates and sometimes spread among neighbouring communities. Zinsser gives an account of a trial at Oxford in 1577 which was followed shortly afterward by the death from typhus, of the Lord Chief Baron, the sheriff, the under-sheriff and all except two of the Grand Jury. Five hundred persons died in all, of whom one hundred were members of the University. In those days the infection was thought to be due to impure air. Conditions in English prisons were not greatly improved until the end of the eighteenth century, after John Howard, who himself died from typhus, published his pamphlet on "The State of the Prisons in England and Wales", and the

British Government had taken over the control of them and instituted reform measures. Dickens included descriptions of eighteenth century prisons in his novels "Barnaby Rudge" and "Little Dorrit". The unclean and lousy condition of the gaols of that period was also recorded by Robert Burns in the following stanza from his Epistle from Esopas to Maria. The Earl of Lonsdale had committed to gaol as vagrants a whole dramatic company which was performing at Whitehaven. The leader of this company, James Williamson, was an acquaintance of Burns. The epistle was written as by Williamson in his prison cell to a lady of his acquaintance:

> "In durance vile here must I wake and weep,
> And all my frousy couch in sorrow steep:
> That straw where many a rogue has lain of yore,
> And vermin'd gipsies litter'd heretofore."

In addition to being prevalent in the gaols, typhus fever quickly spread throughout England following its introduction from the continent, and Zinsser states that there is "no room for doubt that the disease which decimated both the Parliamentary and the Royal armies at the seige of Reading in 1643 was typhus". He also thought it possible that this outbreak sealed the fate of King Charles I by preventing him from advancing upon London.

As stated previously, epidemics of typhus occurred during the World War of 1914-18. It has been estimated that at least ten million cases developed in Eastern Europe, and more than two million persons died of the disease in Russia

alone. It should also be borne in mind that other diseases besides typhus are carried by the louse, including the closely related "trench" fever which made its first appearance during the last Great War and after causing hundreds of thousands of non-fatal casualties, apparently disappeared completely following the cessation of hostilities. With the present knowledge of the role of lice in spreading disease, and improved methods of louse control, the danger of typhus epidemics occurring has been greatly reduced. However, the menace persists and typhus may yet become a factor of prime importance in the present war, particularly on the eastern front where suitable conditions for a major outbreak were developing during the winter of 1941-42, especially among the soldiers of the retreating German armies and the oppressed civil populations.

Since the last war, when the chief method of louse control consisted of periodically subjecting infested clothing to heat while the men bathed, a method that was far from satisfactory, there have been important developments in the insecticide field. Recently, investigations carried out under the direction of the author in his function as an entomologist on the staff of the Division of Entomology, Department of Agriculture, Ottawa, and with the assistance of Ottawa public health authorities and medical officers of the R.C.A.M.C., demonstrated that certain insecticides, notably the thiocyanates, rotenone, and pyrethrum extract, are remarkably effective in

killing all stages of head and pubic lice, and also the sarcoptic mites that cause scabies, another important affliction of the armed forces. If properly applied, these insecticides should go far towards solving the louse and louse-borne disease problems that have harassed and decimated armies and civil populations in the past.

CHAPTER V

Order Hemiptera: The Cicadas, Bedbug, Cuckoo-spits, and Aphids

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The order Hemiptera contains a great variety of insect forms, all of which are characterized by beak-like piercing and sucking mouthparts, two pairs of wings when such are present, and a gradual metamorphosis from the newly hatched nymph to the adult stage. Many of the species are important pests of plant life and multiply rapidly under favourable conditions. When one considers how widespread and abundant some of these insects are, the dearth of allusions to them in English poetry is really surprising. However, it may be that they have been overlooked by the poets, because many of them are drab in colour, elusive in habits, or small in size. Whatever the cause, the fact remains that of the numerous families comprising this order, only four: the Cimicidae, the Cicadidae, the Cercopidae, and the Aphididae, appear to be represented.

Family Cicadidae: The Cicadas.

The cicada is the Tettix of the ancient Greeks, among whom its singing was greatly admired. It is a large, stout-bodied insect with veined membranous wings. It is common in the warmer parts of the world, where its loud shrill song, emanating usually from the shelter of trees,

is familiar to everyone. Certain species of cicadas are common in the United States, and a few occur in southern Canada. A well-known species in the former region is the periodical cicada, or seventeen-year locust, so-called because the adults emerge in large swarms once every seventeen years. The intervening period is spent underground by the slow-growing nymphs, which feed on juices from tree roots. Besides being called locusts and dog-day cicadas, the Cicadidae are sometimes referred to as harvest flies.

In England, where allusions to the cicada have been largely inspired from classical sources, the poets have commonly confused the grasshopper with the cicada. The reason for this is that the only species of cicada recorded in the British Isles, namely, Cicadetta montana Scop., is not numerous, and its song is seldom heard. Another reason may be that the early translators misidentified the Tettix of the Greeks as a grasshopper. About five centuries before Christ, the Greek lyric poet Anacreon wrote an ode to the Tettix. This was rendered in English by Abraham Cowley in the seventeenth century, as Anacreontique No.10, The Grasshopper, part of which is quoted as follows:

> "Happy insect! what can be
> In happiness compared to thee?
> Fed with nourishment divine—
> The dewy morning's gentle wine
> Nature waits upon thee still,
> And thy verdant cup doth fill.
> 'Tis filled wherever thou dost tread,
> Nature's self thy Ganymede.

"Thou dost drink and dance and sing,
Happier than the happiest king....
Thou dost innocently enjoy,
Nor dost thy luxury destroy;
The shepherd gladly heareth thee
More harmonious than he.
Thee country hinds with gladness hear
Prophet of the ripen'd year..."

It is obvious that this poem is not addressed to the grasshopper, which is a very destructive insect and not loved by countrymen who appreciate the extent of its depredations. According to ancient belief the Tettix or Cicada lives on dew in the manner described by the poet. Actually any nourishment that it needs is obtained by piercing the tissues of plants with its beaklike mouthparts and sucking up the juices.

The popular fable by Aesop concerning the ant and the improvident grasshopper, according to Snodgrass (52, p.444), really relates to the ant and the cicada. The cicada after singing lustily all summer while the ant was working, begged for some food from the latter when beset with hunger and cold on the approach of winter. This the ant refused and advised the cicada to dance. The fable has a useful moral, but is biologically unsound, because actually the cicada would have been quite incapable of eating anything the ant could have provided him.

Only the male cicadas have the power to sing. Hence that old rhyme:

"Happy the cicada's lives,
Since they all have voiceless wives."

The musical apparatus of the cicada has been described and

illustrated in detail by Snodgrass. It differs entirely from that of the grasshoppers and crickets, which produce their characteristic songs by means of the legs and wings, or the wings alone. The cicada's instrument consists of a pair of drum-like organs situated at the base of the abdomen just behind the point of attachment of the hind wings. The drum heads or tympana are caused to vibrate by means of strong muscles attached to them inside the body. A large air cavity between the tympana extends back into the abdomen so that the latter actually serves in the office of a drum.

According to Buckton (8), Homer, in the "Iliad" was referring to the cicada (Tettix) when he said:

"Sage chiefs exempt from war, but in discourse abundant,
As the cricket on high,
From the topmost branch of forest tree sends forth
His delicate music...."

Buckton also quotes an ode to the cicada by Meleager rendered in English from the Greek by W. Allingham. A portion of it follows:

"O Tettix! drunk with drops of dew
What musician equals you
In the rural solitude?
On a perch amidst the wood,
Scraping to your heart's desire
Dusky sides with notchy feet,
Shrilling, thrilling fast and sweet,
Like the music of a lyre.
O my Tettix! I entreat
Sing to the Dryads something new,
So, from thick embowered seat,
Pan himself, may answer you,
Till every inmost glade rejoices
With your loud alternate voices;".

The Brownings, among English poets, appear to have taken most notice of the cicada. This was undoubtedly due to their residence in Italy where these insects are plentiful. In the poem Up at a Villa - Down in the City, Robert Browning records that in:

"Late August or early September, the stunning
cicale is shrill,
And the bees keep their tiresome whine round
the resinous firs on the hill."

During a musical contest between Eunonius and Aristomus in Greek mythology, the lyre of one of the players suffered a broken string. Thereupon a cicada alighted on the instrument and added its music to that of the lyre, with the result that the player thereof was awarded the prize. This contest was alluded to by Browning in his poem A Tale:

"All was lost then! No! a cricket
(What 'Cicada'? Pooh!)
—Some mad thing that left its thicket
For mere love of music—flew
With its little heart on fire,
Lighted on the crippled lyre."

The tone and intensity of the cicada's music varies considerably in the different species, which may account to some extent for differences of opinion as to the quality of its song. There is no doubt that in regions where the cicada is abundant its incessant shrilling may become distressing. Elizabeth Barrett Browning hinted at such a condition when she wrote of "those insufferable cicale, sick and hoarse with rapture of the summer heat, that sing, like poets, till their hearts break". Aldous Huxley, in The Cicadas, registered

positive abhorrence for their song, which he called "the living silence of continuous sound".

"For like inveterate remorse, like shrill
Delirium throbbing in the fevered brain,
An unseen people of cicadas fill
Night with their one harsh note, again, again.

"Again, again, with what insensate zest!
What fury of persistence, hour by hour!
Filled with what devil that denies them rest,
Drunk with what source of pleasure and of power!

"Life is their madness, life that all night long
Bids them to sing and sing, they know not why;
Mad cause and senseless burden of their song;
For life commands, and Life! is all their cry."

Family Cimicidae: The Bedbug.

Walton (60, p.196) quotes Samuel Butler's Hudibras as the only English poem containing a reference to the common bedbug, Cimex lectularius L., and this under the name of "punese", probably a derivation from the French word punaise. The quoted matter follows:

"Swore you had broke and robbed his house,
And stole his talismanique louse,...
His flea, his morpion, and punese,
He had gotten for his proper ease,
And all in perfect minutes made,
By th' ablest artists of the trade;
Which he could prove it since he lost,
He has been eaten up almost."

This refers to the superstitious practice current in the Middle Ages and probably persisting into the Renaissance of wearing talismans as a protection against various ills.

Although the obnoxious bedbug is very common and widespread throughout Europe and North America there are

probably many people who are not familiar with this pest. It is a flattened, oval, reddish-brown, wingless insect, measuring about one-quarter of an inch in length when full grown. It feeds only on blood and is chiefly active at night when its victims are asleep, hiding during the daytime in convenient cracks and crevices where it lays its small, white eggs, perhaps two hundred in all, over a period of several months.

There appears to be no record of the bedbug's first arrival in England from warmer latitudes, but it undoubtedly has been well established for many centuries. Burr (9,165) states that bedbugs were first alluded to by Humphrey Llwyd about 1550 as "small stynkynge wormes which live in paper and wood, called Cimices". The old English name for them was "chinche" or "wall-louse", and they were subsequently called bugs in the sense of bugbear or bugaboo, a fearful thing of the night, a term used on several occasions in Shakespeare's plays.

According to Kirby and Spence, Mouffet, in Theatrum Insectorum (40), recorded that in 1583 his friend, Dr. Penny, a naturalist, and physician to Queen Elizabeth, was summoned to "a little village called Mortlake near the Thames, to visit two noble ladies, who were much frighted by perceiving the prints of wall-lice, and were in doubt of I know not what contagion. But when the matter was known, and the wall-lice

were catched, he laught them out of all fear". Mouffet mentioned a list of materials recommended by "old and new authors" which included among other things, ox dung, horse hair, swallows, arsenic, and a variety of plant life, the smoke from which was supposed to be an effective remedy against the bugs. Of all the items included the only one of any likely value was brimstone. One of the first English publications on economic entomology was "A Treatise of Buggs" by John Southall, published in London in 1730, which described a "Nonpariel Liquor for Destroying Buggs and Nits" made up according to a formula which the author claimed to have obtained from a West Indian negro. It was probably no more effective than the remedies set forth by Mouffet.

Family Cercopidae: Frog-hoppers or Cuckoo-spits.

During the summer, one may often see conspicuous frothy objects like small balls of human spittle adhering to plants and grasses, the latter especially in low-lying meadows. A close examination of one of these so-called cuckoo-spits would reveal hidden in the heart of the protecting froth a small, helpless, pale and delicate creature, which is the young or nymph of the actively jumping insect known as the frog-hopper.

The poet Herrick, who must have been very familiar with the spittle-bug's exudation on the plants in his Devonshire garden, evidently considered it fit food for a

fairy king, for in his Hesperides (A.D. 1648) he records that King Oberon, at the fairies' feast spies:

> "The horns of papery butterflies,
> Of which he eats, and tastes a little
> Of what we call the cuckoo's spittle."

The exudate comprising the spittle is secreted from the abdomen of the insect and blown into an enveloping froth with air expelled through the spiracles. Apparently, its function is a dual one: namely, to protect the insect's soft body from sunlight and dessication, and to ward off attacks by insect enemies.

Tennyson, too, alluded to the cuckoo-spit, but under the synonym of frothfly. This was in his poem Aylmer's Field (L.530), as follows:

> "The father panting woke, and oft, as dawn
> Aroused the black republic on his elms,
> Sweeping the frothfly from the fescue, brush'd
> Thro' the dim meadow toward his treasure-trove,".

Tennyson's description identifies the species as probably Philaenus lineatus L., which occurs chiefly on grasses.

Family Aphididae: The Aphids or Plant Lice.

It is perhaps not necessary to give a description of the aphids for, being among the most common and prolific of insects and feeding and multiplying on a great variety of plant hosts, they are familiar to everyone. This being so, it is the more surprising that the poets, with one exception, have apparently ignored them. The exception is Erasmus Darwin,

grandfather of two illustrious scientists: Charles Darwin, of evolution fame; and Francis Galton, student of heredity. In the poem, Origin of Society, he gives a brief but accurate picture of them in the following rhymed couplets:

> "The countless aphides, prolific tribe
> With greedy trunks the honey'd sap imbibe;
> Swarm on each leaf with eggs or embryons big,
> And pendant nations tenant every twig."

CHAPTER VI

Order Lepidoptera: The Butterflies and Moths

This great insect order comprising the butterflies and moths is probably the one most familiar to the average person. It includes scale-covered, four-winged insects, which have sucking mouthparts in the form of a long, flexible tube-like proboscis. These insects have a complete metamorphosis through the egg, larva, pupa and adult stages. According to Imms (30) probably not less than 80,000 species have been described (another author puts the figure at 120,000) of which more than 2000 occur in the British Isles. Perhaps less than ten per cent of these species are butterflies, the remainder being moths. Some authors separate the Lepidoptera into two sub-orders: namely, the Rhopalocera, or club-horns (butterflies), and the Heterocera, or horns of another kind (moths), but in a more modern system of classification the butterflies are considered as merely a superfamily (Papilionina) of the order. For practical purposes the following easily recognisable features may be used to distinguish between them. The moths are predominently night-fliers; their antennae are feathered, or threadlike, rarely clubbed; when at rest they hold their wings flat or folded against the body. The butterflies, on the other hand, have slender antennae clubbed at the tip, they fly by day,

PLATE III - Above: a swallowtail butterfly.
Below: the luna moth.

and when resting hold the wings together vertically over the back.

The Butterflies

"The butterfly the ancient Grecians made
The Soul's fair emblem, and its only name."
- Coleridge

To most people, especially those who are not professional entomologists, the butterflies are the most beautiful and the best known among the insects. This is because the attractive colour patterns formed by the scales on their two pairs of large and graceful wings are displayed to advantage by their fluttering, dancing, unhurried mode of flight. Moreover, they are active during the daylight hours, when their visits to gardens and across the meadows and woodland in search of nectar from the flowers reveal them to best advantage against a background of rural loveliness, which greatly enhances their natural aesthetic appeal. Thomas Hood described them as

"These... pretty genii of the flowers,
Dainty fed with honey and pure dew."

Keats, too, in Endymion (IV.937) expressed well the popular conception of the butterfly when he referred to it as "a lord of flowers, garlands, love-knots, silly posies, groves, meadows, melodies, and arbour roses;".

Spenser in his poem Muiopotmos or the Fate of the Butterflie, of which two stanzas follow, describes the apparent happy and carefree life of a butterfly before it is cruelly

slain by one of its natural enemies, the spider. The butterfly seeks out a garden and after:

"There arriving, round about doth flie,
From bed to bed, from one to other border;
And takes survey, with curious busie eye
Of every flowre and herbe there set in order;
Now this, now that, he tasteth tenderly,
Yet none of them he rudely doth disorder,
He with his feete their silken leaves deface;
But pastures on the pleasures of each place.

. . . . . .

"What more felicitie can fall to creature
Than to enjoy delight with libertie,
And to be lord of all the workes of Nature?
To raigne in th' aire from th' earth to highest skie,
To feed on flowres, and weeds of glorious feature?
To take whatever thing doth please the eie?
Who rests not pleased with such happines
Well worthy he to taste of wretchednes."

The name "butterfly" derives from the old English "buttor-fléoge". The association of the insect with butter may be due to the yellow colour of certain very common species belonging to the family Pieridae, known as "clouded yellows" and "brimstones". In Chaucer's day; that is, in the fourteenth century, the word was spelled "boterflye". Chaucer himself apparently considered butterflies things of no account, as indicated in the few allusions to them that occur in his works, such as the one in The Marchante's Tale, wherein Queen Proserpyne refutes her husband's accusations against women by stating simply that:

"I sette noght of al the vileinye,
That ye of wommen wryte, a boterflye."

Byron, too, in Sardanapolus (V.1), gave a similar value to

the word when he referred to a character as:

> "A mere court butterfly,
> That flutters in the pageant of a monarch."

Rather strange to relate, in view of the beauty of these creatures, the references to butterflies in Shakespeare are few and casual. In Troilus and Cressida (III.3), Achilles wonders at the rather contemptuous manner shown towards him by his fellow Grecian commanders and remarks:

> "'Tis certain, greatness, once fall'n out with fortune,
> Must fall out with men too: what the declined is,
> He shall as soon read in the eyes of others
> As feel in his own fall: for men, like butterflies,
> Show not their mealy wings but to the summer;".

Again, in Coriolanus (I.3), when Coriolanus at the head of the Volscians is threatening Rome, Cominius describes the former to Menenius:

> "He is their God: he leads them like a thing
> Made by some other diety than Nature,
> That shapes man better; and they follow him,
> Against us brats, with no less confidence
> Than boys pursuing summer butterflies,".

A more direct allusion is that in Midsummer Night's Dream (III.1) when Titania, in her bewitched love for Bottom with his ass's head, orders her fairy attendants to

> "... pluck the wings from painted butterflies
> To fan the moonbeams from his sleeping eyes:".

Children, with their keen senses not yet blunted by adversity, disillusionment, or the cynicism that may accompany maturity, are naturally observant and appreciative of the beauties of nature. It is, perhaps, a common experience to

recall with a feeling of nostalgia the impressions of childhood apparently received in a fairyland which, if non-existent to adults, is real enough to the child mind. Wordsworth expressed something of this feeling in his poem To a Butterfly, written at Grasmere, on March 14, 1802, in reference to childhood days spent at Cockermouth before 1778.

"Stay near me - do not take flight!
A little longer stay in sight!
Much converse do I find in thee,
Historian of my infancy!
Float near me; do not yet depart!
Dead times revive in thee:
Thou bring'st, gay creature as thou art,
A solemn image to my heart,
My father's family!

"Oh, pleasant, pleasant were the days,
The time when, in our childish plays,
My sister Emmeline and I
Together chased the butterfly!
A very hunter did I rush
Upon the prey - with leaps and springs
I followed on from brook to bush,
But she, God love her, feared to brush
The dust from off its wings."

The dust from off the butterfly's wings is made up of tiny scales of regular shape which are usually arranged in overlapping rows like the shingles on a roof. These scales serve as a protective covering for the body and its appendages, including the wings, and also increase the rigidity of the latter. Another function of the scales is to produce the beautiful colour patterns which rightly have such a widespread appeal. In northern latitudes such as the British Isles the colouration is probably largely due to the presence of pigments,

but the brilliant, iridescent colours of tropical forms are produced by physical and chemico-physical means as well, arising from the structure and arrangement of the scales. The poets were aware of the delicate and fragile nature of the scales on a butterfly's wings. Keats, in Endymion (II.61) wrote of:

> "A golden butterfly; upon whose wings
> There must be surely character'd strange things,
>
> . . . . . .
>
> "Onward it flies,... then high it soar'd,
> And, downward, suddenly began to dip,
> As if, athirst with so much toil, 'twould sip
> The crystal spout-head; so it did, with touch
> Most delicate, as though afraid to smutch
> Even with mealy gold the waters clear."

Everyone who has attempted to collect butterflies knows how easily the scales are rubbed off and the attractive colours and markings defaced or destroyed. The disappointment of the collector when this happens has been well expressed by Byron in the lines:

> "The lovely toy so fiercely sought
> Has lost its charm by being caught,
> For every touch that wooed its stay
> Has brushed its brightest hues away."

Among the scales on the wings, especially in the males, are some modified ones called androconia, which release perfumes and are supposed to attract members of the opposite sex.

The remarkable transition of the humble lepidopterous worm or caterpillar to beautiful butterfly has long fascinated poets and other writers, and has inevitably been regarded as

symbolical of the transformation which takes place in man when his spirit is released from its earthly prison on the death of his body. That this insect is, in fact, an ancient symbol of the human soul is indicated by the Greek word Psyche which means both a butterfly and the soul. Samuel Rogers gave expression to this thought in the following lines from his poem To the Butterfly:

"Child of the sun, pursue thy rapturous flight,
Mingled with her thou lov'st, in fields of light;
And where the flowers of Paradise unfold,
Quaff fragrant nectar from their cups of gold.
There shall thy wings, rich as an evening sky,
Expand and shut with silent ecstasy.
Yet wert thou once a worm, a thing that crept
On the base earth, then wrought a tomb, and slept.
And such is man: soon from his cell of clay
To burst a seraph in the blaze of day."

In the past it was a popular practice among authors of books on butterflies and moths to adorn their texts with appropriate verses. Among several of those relating to the metamorphosis of butterflies the following stanzas copied from Haworth's "Lepidoptera Britannica", published in London in 1803, are typical. The name of the poet was not given.

"See to the sun the Butterfly displays
Its glittering wings, and wantons in his rays:
In life exulting, o'er the meadows flies,
Slips from each flow'r, and breathes the vernal skies.

"How glorious now! how chang'd since yesterday!
When on the ground, a crawling worm it lay!
Where ev'ry foot might tread its soul away!
Who rais'd it thence? and bid it range the skies?
Gave its rich plumage, and its brilliant dyes?

"'Twas God.- Its God and thine, O Man, and he
In this thy fellow-creature lets thee see
The wondrous change which is ordain'd for thee.
Thou too shalt leave thy reptile form behind,
And mount the skies, a pure ethereal mind,
There range among the stars, all bright and unconfin'd."

A more modern poet, Charles Dalmon (B.1862) has expressed a similar thought in an Elegy for Edward Thomas, the last stanza of which reads:

"As from a chrysalis we see
The lovely butterfly set free,
From our dead bodies dead men's eyes
May see our deathless souls arise."

The butterfly's transformation from the caterpillar stage was used by Shakespeare in his play Coriolanus (V.4) to illustrate the extent of the metamorphosis of the leading character from ordinary citizen to victorious leader of an army. After Marcius Coriolanus, a native of Rome, had overthrown the city at the head of the Volscians, a Roman noble, Sicinius, astonished at the prowess of Coriolanus, asked:

"Is't possible that so short a time can
alter the conditions of a man?"

To which Menenius replied:

"There is differency between a grub and a
butterfly; yet your butterfly was a grub.
This Marcius is grown from man to dragon:
he has wings; he's more than a creeping thing."

The various species of Lepidoptera have definite host preferences and their larvae feed upon the same kinds of plants from generation to generation. The butterflies are guided to the favoured plants by an olfactory sense which is

believed to be located in the palpi. In general, the caterpillars of butterflies are not very destructive: most of the economic pests among the Lepidoptera being the larvae of moths. An exception are the white cabbage butterflies of the family Pieridae, of which Pieris rapae L., is the chief culprit. This species is abundant throughout Europe, Asia, and North America, and its well-known green caterpillars do a great deal of damage to cabbages and other cruciferous vegetables. It was this or a related species that Tennyson referred to in Guinevere. Sir Modred was spying on Queen Guinevere and her ladies from the high top of the ivy-clad garden wall when:

> "... Sir Lancelot passing by
> Spied where he couch'd, and as the gardener's hand
> Picks from the colewort a green caterpillar,
> So from the high wall and the flowering grove
> Of grasses Lancelot pluck'd him by the heel,
> And cast him as a worm upon the way;".

Hand-picking of caterpillars from infested plants used to be a common practice before the development of easier, more effective control measures. Kipling, in Butterflies, tells how children chase the cabbage butterflies and in the process sting and scratch themselves on nettles and brambles:

> "Then to quiet them comes their father
> And stills the riot of pain and grief,
> Saying, 'Little ones, go and gather
> Out of my garden a cabbage-leaf.
>
> "'You will find on it whorls and clots of
> Dull grey eggs that, properly fed,
> Turn, by way of the worm, to lots of
> Glorious butterflies raised from the dead'."

The "whorls and clots" observed by Kipling were not "dull grey

eggs", however, but some of the plentiful excretions of the voracious green caterpillars. The eggs of the cabbage butterfly are tiny objects of regular form, cone-shaped, ribbed, and glistening.

It was doubtless one of these conspicuous white butterflies that R.H. Horne described in his delightful poem Far Out at Sea. Some species of butterflies, including the cabbage butterfly, sometimes migrate long distances and frequently cross large bodies of water, but as this one was a lonely specimen it was perhaps an accidental wanderer. Three stanzas of Horne's poem follow:

"Far out at sea--the sun was high,
While veered the wind and flapped the sail;
We saw a snow-white butterfly
Dancing before the fitful gale
Far out at sea.

"Away he sped, with shimmering glee,
Scarce seen, now lost, yet onward borne!
Night comes with wind and rain, and he
No more will dance before the morn,
Far out at sea.

"He dies, unlike his mates, I ween,
Perhaps not sooner or worse crossed;
And he hath felt and known and seen
A larger life and hope, though lost
Far out at sea."

Algernon Swinburne evidently saw a migrating flight of these butterflies going out to sea, for he wrote:

"Fly, white butterflies, out to sea,
Frail pale wings for the winds to try;
Small white wings that we scarce can see,
Fly."

Most of the feeding in a butterfly's life-cycle occurs during the larval stage. The caterpillars are obliged to eat heartily as they have to provide not only for present growth, which involves several complete new skins to replace moulted ones, but also for reserves of sustenance and energy required to carry the insect through the pupal stage and into the adult form. The pupa or chrysalis from which the winged insect finally emerges has been likened by Shelley, in the Sensitive Plant (II.41-56), to "an ante-natal tomb, where butterflies dream of the life to come". This "ante-natal tomb" in a good proportion of butterflies is naked and suspended by the tail end which is hooked into a pad of silk attached to some convenient object. In many cases this support is reinforced by a silken girdle. Finally when the transformation is complete and the time for emergence arrives the pupal skin splits open, the butterfly forces its way out and, after expanding and drying its wings, "mounts on high, no longer reptile, but endowed with plumes, and through the blue air wanders"; or, as J. Thomson describes it, in The Castle of Indolence (I.75):

> "See her bright robes the butterfly unfold,
> Broke from her wintry tomb in prime of May.
> What youthful bride can equal her array?
> Who can with her for easy pleasure vie?
> From mead to mead with gentle wing to stray,
> From flower to flower on balmy gales to fly,
> Is all she has to do beneath the radiant sky."

Alfred Noyes, in Butterflies, described them as "fairies plumed with green rainbow-sheen" and suggested that they had been banished from their fairy glade, and

"Now they roam these mortal dells
Wondering where that happy glade is,
Painted Ladies,
Admirals and Tortoise-shells."

The sight of a butterfly on the wing recalls to mind joyous summer days in the countryside and may interfere with intended industry, as in the following stanza from Richard LeGallienne's Transgression:

"I meant to do my work to-day --
But a brown bird sang in the apple-tree,
And a butterfly flitted across the field,
And all the leaves were calling me."

The bright colours and attractive appearance of butterflies ensure their popularity with children. It is only natural then that the butterfly should be the central figure in a number of rhymes that have had a wide appeal in the nursery. One of the earliest of these was a 38-line fable in verse with a moral, written by John Gay, which leads off with: "As in the sunshine of the morn". In it a butterfly scorns the humble snail who, in retaliation, reminds her of her caterpillar origin. It reveals a knowledge of the butterfly's life-history in Elizabethan times.

During the early part of the nineteenth century William Roscoe (1753-1831) wrote The Butterfly's Ball and the Grasshopper's Feast, followed by The Butterfly's Birthday, and a sequel, The Butterfly's Funeral. Weiss (64) in an article

on nursery insects stated that although Roscoe "was an attorney, one of the founders of a Liverpool society for the encouragement of the arts of painting and design, a botanist, a poet, a banker, a student of Greek, an author in diverse subjects, etc., and he has three pages devoted to him in the Dictionary of National Biography", he is remembered by many solely as the author of the Butterfly's Ball and the Grasshopper's Feast. This rhyme which was published in the "Gentleman's Magazine", November, 1806, is made up of sixteen stanzas and besides the butterfly and the grasshopper, introduces nine different kinds of insects including the Gad-fly, the Beetle, the Emmet, the Gnat, the Dragon-fly, the Moth, the Wasp, the Bee and the Glow-worm. The following four stanzas are enough to illustrate the nature of this pleasant childish rhyme:

"Come take up your hats,
And away let us haste,
To the Butterfly's Ball
Or the Grasshopper's Feast.

"The Trumpeter Gad-fly,
Has summon'd the crew,
And the revels are now
Only waiting for you.

. . . .

"The viands were various,
To each of their taste,
And the Bee brought the honey
To sweeten the feast.

. . . .

"Then as the evening gave way
To the shadows of night,
Their watchman the glow-worm
Came out with his light."

The emergence of a butterfly from its chrysalis and the beauty of its form and life are described in The Butterfly's Birthday, and a lesson drawn regarding the spiritual future of man. This poem consists of twenty verses of which the following are representative:

"The shades of night were scarcely fled;
The air was mild, the winds were still;
And slow the slanting sunbeams spread
O'er wood and lawn, o'er heath and hill.

. . . . .

"When bursting forth to life and light,
The offspring of enraptured May,
The Butterfly on pinions bright,
Launched in full splendour on the day,

. . . . .

"Go child of pleasure, range the fields,
Taste all the joys that spring can give,
Partake what bounteous summer yields,
And live while'st yet 'tis thine to live.

. . . . .

"Shall the poor worm that shocks thy sight,
The humblest form in nature's train,
Thus rise in new-born lustre bright,
And yet the emblem teach in vain?"

Another author who wrote about the butterfly for children was R.C. Barton who, in 1820, published in London, Chrysallina, or the Butterfly's Gala. A copy is not to hand but Weiss (64) states that it is a 48-page book of verses presented under six headings: namely, The Ball, The Masquerade, The Race, The Theatre, The Tournament, and The Departure. The following example of the work was copied from Weiss who considered the poem a good-natured satire on court life:

"So if you sit still, you shall hear of the call
To the Butterfly's Gala at Chrysalis hall,--
But first you must know, that of insects the queen,
Long the leader of fashion the Butterfly's been,
For like many gay ladies that glitter at court,
She has nothing to do but her beauty to sport,
No children to nurse, and no husband to cherish,
The poor may go hungry, the sickly may perish,
As long as she flutters, and basks in the sun,
She cares not who dies, and p'rhaps laughs at the fun."

The life of the butterfly, however, is not all "beer and skittles" as some of the writers quoted appear to imagine, for throughout the different stages of its life-cycle it is subject to the attacks of many enemies, including insect parasites and predators, disease organisms, and various small mammals and birds. One poet who observed a phase of natural control in operation and recorded his feelings thereon is Wordsworth. In April, 1802, while at Grasmere, he saw a robin, one of the most generally loved of English song birds, pursuing a butterfly and this is what he wrote:

"What ailed thee, Robin, that thou could'st pursue
A beautiful creature,
That is gentle by nature?
Beneath the summer sky,
From flower to flower let him fly;
'Tis all that he wishes to do.
The cheerer Thou of our in-door sadness,
He is the friend of our summer gladness:".

The Redbreast Chases the Butterfly.

The Moths

As mentioned at the beginning of this chapter, a large proportion of the species in the order Lepidoptera are called moths, most of which differ from the butterflies in possessing feathered or threadlike antennae, in holding their wings while at rest in a horizontal position or folded over the abdomen, and in flying chiefly at night, and being attracted to lights. A further point of difference is that with few exceptions the butterflies are comparatively innocuous whereas the moths are of very great economic importance, their larvae causing immense annual losses to field and garden plants and forest, shade, and fruit trees, and also to fabrics and stored products of all kinds. On the credit side must be mentioned the valuable silk produced by the larvae of the silkworm moths.

The fatal attraction that light has for the night-flying moths was noted by a number of English poets. In Shakespeare's day it was the crude and feeble candle that drew the moths. Shakespeare mentions it in The Merchant of Venice (II.9), in the words of Portia uttered when the Prince of Arragon, disappointed in his efforts to obtain her hand, departs:

"Thus hath the candle singed the moth."

In John Gay's Beggar's Opera (I.4), Mrs. Peachum uses the moth to moralize on her daughter Polly's love for a highwayman. She sings:

"If love the virgin's heart invade,
How, like a moth, the simple maid
Still plays about the flame!"

Fly screens are not so necessary in England as in North America and in the past have not been so widely used. One may imagine, then, that poets and other writers busy on summer evenings beneath their lamps must have been frequently startled or annoyed by the intrusion of moths and other insects through open windows from outdoors. Thomas Carlyle, indeed, wrote a poem on The Tragedy of the Night-Moth. This poem points a moral and is coloured to some extent with pessimism and self pity, which may have been due to Carlyle's habitual dyspepsia and overwork. Eight of the fourteen stanzas follow:

"'Tis placid midnight, stars are keeping
Their meek and silent course in Heaven;
Save pale recluse, for knowledge seeking,
All things to sleep are given.

"But see! a wandering Night-moth enters,
Allured by taper gleaming bright;
Awhile keeps hovering round, then ventures
On Goethe's mystic page to light.

"With awe she views the candle blazing;
A universe of fire it seems
To moth-savant with rapture gazing,
Or Fount whence Life and Motion streams.

"What passions in her small heart whirling,
Hopes boundless, adoration, dread;
At length her tiny pinions twirling,
She darts, and--puff!--the moth is dead.

. . . . .

"Poor moth! near weeping I lament thee,
Thy glossy form, thy instant woe;
'Twas zeal for 'things too high' that sent thee
From cheery earth to shades below.

. . . . .

"Like thee, with common lot contented,
With humble joys and vulgar fate,
I might have lived and ne'er lamented,
Moth of a larger size, a longer date!

"But Nature's majesty unveiling
What seemed her wildest, grandest charms,
Eternal Truth and Beauty hailing,
Like thee, I rushed into her arms.

"What gained we, little moth? Thy ashes,
Thy one brief parting pang may show:
And thoughts like these, for soul that dashes
From deep to deep, are--death more slow!"

According to Byron, in his English Bards and Scotch Reviewers, "maidens like moths are ever caught by glare, and Mammon wins his way where seraphs might despair". His contemporary, Shelley, also employed the moth's weakness for light in two similes. In Epipsychidon, he says, "Sweet Lamp! my moth-like Muse has burnt its wings:" and in Medusa (IV.6), he uses the words, "like a moth that hies after a taper". The irresistable reaction of the moth to the stimulation of light on its optic nerves was recorded by Tennyson, in Sir John Oldcastle (189):

"The moth will singe her wings, and
singed return,
Her love of light quenching her
fear of pain."

In scientific language, insects such as moths which are attracted towards the source of light are said to be "positively phototropic".

The moth life-history is broadly similar to that of the butterflies, the insects progressively passing through

the egg, caterpillar, and pupal or chrysalis stages, to the winged adult form. In the details, of course, there are marked variations among the different species. In all of them it is only the caterpillars that are injurious. According to the Oxford Dictionary, the name caterpillar is perhaps derived from the old French chatepelose which means literally "hairy-cat" Many species of caterpillars are thickly covered with hairs.

The Bible contains a number of references to the caterpillar (I Kings, 8.37), cankerworm, and palmerworm (Joel 1.4 Some students believe that the translators were none too sure of the precise meaning of the original Hebrew words denoting insect pests and compromised by interpreting them in the form of common English species. Topsell (57) is quoted as recording in the seventeenth century that there is in England a kind of caterpille which "doo wander and stray hither and thither and like Mise, consume and eat up that which is none of their owne; and these have purchased a very apt name amongst us Englishmen, to be called Palmerworms, by reason of their wandering and rogish life, although by reason of their roughness and ruggedness some call them Beare-wormes." Further, in England the name cankerworm might be given to any caterpillar that feeds upon plant foliage. As suggested in the section on grasshoppers, the original Hebrew names may actually have referred to the different life-stages of the locust.

Damage done by moth larvae has been alluded to on numerous occasions in poetry and drama. In Chaucer's

Wyf of Bathe's Tale (376) is the remark:

"Thou seyst, that right as wormes shende a tree,
Right so a wyf destroyeth hir housbonde;
This know they that been to wyves bonde."

Spenser wrote of "the goodly Oak" in The Shepheard's Calendar (F.13) that:

"His bared boughes were beaten with stormes,
His toppe was bald, and wasted with wormes,"

and further (F.179) that the ill-intentioned briar (Brere) complained to the husbandman that the old oak was overcrowding it:

"And oft hee lets his cancker-wormes light
Upon my braunches, to worke me more spight;".

The cankerworm may have been the oak-tree pug, Eupithesia dodoneata, which feeds on the young leaves of oak in southern English woods.

Shakespeare found the caterpillar a very useful creature to illustrate his meanings. In the poem Venus and Adonis, Adonis rebuffed the passionate advances of Venus, saying:

"Call it not love, for love to heaven is fled,
Since sweating lust on earth usurp'd his name;
Under whose simple semblance he hath fed
Upon fresh beauty, blotting it with blame;
Which the hot tyrant stains, and soon bereaves,
As caterpillars do the tender leaves."

Destructive elements in the kingdom are likened to caterpillars in King Richard II (II.3 and III.4). Bolingbroke called Richard's creatures Bushy and Bagot and their accomplices: "The caterpillars of the commonwealth, which I have sworn to weed and pluck away". Again, when the gardener instructed the servant to "cut off the heads of the too fast-growing sprays"

in the garden the latter, also referring to subversive elements in the community, protested:

> "Why should we in the compass of a pale
> Keep law, and form, and due proportion,
> Showing, as in a model, our firm estate;
> When our sea-walled garden, the whole land,
> Is full of weeds; her fairest flowers choked up,
> Her fruit-trees all unpruned, her hedges ruin'd,
> Her knots disorder'd, and her wholesome herbs
> Swarming with caterpillars?"

The poet's awareness of the great damage that moth larvae may do was further demonstrated in 2 Henry VI (III.1). When the Duke of Somerset reported to King Henry that he had lost all his French territories, the scheming Duke of York muttered to himself:

> "Cold news for me; for I had hope of France....
> Thus are my blossoms blasted in the bud,
> And caterpillars eat my leaves away."

Shakespeare sometimes substituted for caterpillars the terms "canker" or merely "worm" to denote injurious lepidopterous larvae. For instance, in Romeo and Juliet (I.1), Montague says of his son Romeo that he is:

> "... to himself so secret and so close,
> So far from sounding and discovery,
> As is the bud bit with an envious worm
> Ere he can spread his sweet leaves to the air,
> Or dedicate his beauty to the sun."

And Viola, in Twelfth Night (II.4), while masquerading as a boy, tells the Duke of Illyria, whom she loves, that her "sister"

> "... never told her love;
> But let concealment, like a worm i' the bud,
> Feed on her damask cheek."

In The Two Gentlemen of Verona, Proteus excused himself on being in love by remarking to his friend Valentine:

"Yet writers say: as in the sweetest bud
The eating canker dwells, so eating Love
Inhabits in the finest wits of all."

To which Valentine made withering reply:

"And writers say: as the most forward bud
Is eaten by the canker ere it blow,
Even so by Love the young and tender wit
Is turned to folly; blasting in the bud,
Losing his verdure even in the prime,
And all the fair effects of future hopes."

There are at least half a dozen similar allusions to moth larvae in Shakespeare's plays, but one more must suffice. This occurs in Midsummer Night's Dream (II.2), when Queen Titania instructed some of her fairy attendants: "To kill cankers in the musk-rose buds".

Milton, too, showed familiarity with the caterpillars that cause injury and death to the beautiful blossoms of the rose, in the following lines from Lycidas:

"As killing as the canker to the rose,
Or taint-worm to the weanling herds that graze,
. . . . .
"Such Lycidas, thy loss to shepherd's ear."

The forthright Robert Burns once likened the Duke of Queensbury to a destructive insect. In 1795 the Duke stripped the woods from certain of his domains in Dumfriesshire and Peebleshire to raise money. In his poem Burns asked the genius of the River Nith who had removed the trees, whether wind, lightning or cankerworm;

"'Nae eastlin blast', the sprite replied,
'It blew na here sae fierce and fell,
And on my dry and halesome banks
Nae cankerworms get leave to dwell:
Man! cruel man!' the genius sighed--
As through the cliffs he sank him down--
'The worm that gnawed my bonny trees,
That reptile wears a ducal crown.'"

In the opinion of Shelley, the untimely death of the poet Keats was hastened by a severe criticism of his Endymion, which appeared in the Quarterly Review. In the preface to Adonais (1821), an elegy on the death of John Keats, Shelley gave expression to this conviction and referred to the critics as "canker-worms". Said he: "Where canker-worms abound, what wonder, if its young flower (of Keat's genius) was blighted in the bud". However, Shelley was apparently not well informed about insects, or had an undue sympathy for some of them, for in The Sensitive Plant he refers to "soft moths that kiss the sweet lips of the flowers, and harm not". Actually most moths are harmful to some extent in their larval form. He reveals the same sentimental regard for insect pests in two other stanzas of the same poem. A sensitive plant was growing in a garden tended from dawn till dusk by a lady.

"And all killing insects and gnawing worms,
And things of obscene and unlovely forms,
She bore in a basket of Indian woof,
Into the rough woods far aloof,--

"In a basket of grasses and wild flowers full,
The freshest her gentle hands could pull,
For the poor banished insects, whose intent,
Although they did ill, was innocent."

In practice, of course, the insects would probably not be long finding their way back to the garden in greater numbers than ever, for most of them are very persistent -- and prolific. Moreover, such control measures would not likely be popular with the neighbours.

Cowper showed a more usual conception of insect pests when he wrote of:

> "... caterpillars dangling under trees
> By slender threads and swinging in the breeze,
> Which filthily bewray and sore disgrace
> The boughs in which are bred th' unseemly race."

This may refer to the larvae of the lackey moth of Europe, Malacosoma neustria L., which construct silken tent-like webs in trees and feed on the foliage. This species is generally distributed in England and is especially injurious to the foliage of fruit trees. Related species in North America are called tent-caterpillars and are widespread pests of deciduous forest, shade and fruit trees.

People generally, when they hear the word moth, think of one particular kind of moth, the clothes moth. This is because most people at one time or another suffer losses due to the activities of this ubiquitous pest. At least two species: the case-making clothes moth, Tinea pellionella L., and the webbing clothes moth, Tineola biselliella Hum., are common and widely distributed, the latter being the more abundant and destructive.

Clothes moths have been troublesome pests to man

for a very long time. The Bible contains several allusions to them. In Isaiah (51.8) appears the statement:

> "The moth shall eat them up like a garment, and the worm shall eat them like wool."

In Matthew (6.19) the following advice is given:

> "Lay not up for yourselves treasures upon earth, where moth and rust doth corrupt, and where thieves break through and steal: but lay up for yourselves treasures in heaven, where neither moth nor rust doth corrupt, and where thieves do not break through nor steal."

The clothes moth adults do no damage, they merely mate and lay eggs. It is only the larvae that are injurious. These feed exclusively on materials of animal origin such as wool, fur, feathers, and silk from the silkworm. Vegetable matter such as cotton is immune to them. Evidently wool was one of the chief materials used by the ancients to retain bodily warmth. Aristotle said of the moth in his "History of Animals" (V.26): "There are other small animals... some of which occur in wool and woollen goods, as the worm (ses) and these animals come in the greatest numbers when the wool is dusty." The generally accepted fact that moths do most damage to unused, unbrushed clothing was apparently common knowledge in Aristotle's day. It was certainly known in fourteenth century England for in Chaucer's Canterbury Tales, the Wyf of Bathe remarked that when she went abroad visiting she wore her "gaye scarlet gytes" (skirt or mantle), and:

> "These wormes, ne these motthes, ne these mytes,
> Upon my peril, frete (consumed) hem never a deel;
> And wostow why? for they were used weel."

This was translated by Pope in his Paraphrases from Chaucer: Prologue, The Wife of Bath, as:

> "The wasting moth ne'er spoil'd my best array;
> The cause was this, I wore it every day."

Chaucer made an apt allusion to the clothes moth in The Tale of Melibeus, thus:

> "Solomon seith: that right as motthes in the shepes flees anoyeth to the clothes, and the smale wormes to the tree, right so anoyeth sorwe (sorrow) to the herte."

It is the habit of the clothes moths and their larvae to avoid light; in other words they are negatively phototropic. Because of this, the concealed portions of susceptible goods are most likely to be damaged by them. This important ecological fact was pointed out by Spenser nearly four centuries ago, in the Faery Queen (II.ii.34), in his description of the feelings of two sisters towards another sister, when they were entertaining the knights of opposing forces during a truce after a fight.

> "For both did at their second sister grutch
> And inly grieve, as doth an hidden moth
> The inner garment frett, nor the 'utter touch."

As one would expect, the observant Shakespeare was familiar with the destructive proclivities of clothes moths. Thus, in Much Ado About Nothing (III.3), Borachio refers to "the smirched moth-eaten tapestry", and, in Coriolanus (I.3) Valeria says to her friend Virgilia, who refused to put away her knitting

> "You would be another Penelope; yet, they say, all the yarn she spun in Ulysses' absence did but fill Ithaca full of moths."

In view of the length of Ulysses' absence visiting Troy this, perhaps, was not surprising.

Nowadays, higher living standards and the general distribution of goods produced by modern science and technology have greatly increased the moth's destructive potentialities. On the other hand, ways and means of preventing moth damage have been developed and people are better informed on the subject of control than they were a few generations ago. In the year 70 A.D. Pliny wrote in his "Natural History", that "a suit of clothes placed upon a coffin will be forever proof against the teeth of moths". A belief of the Middle Ages passed on by Mouffet was that clothes "wrapped in the skin of a lion have nothing to fear". This sort of thing, of course, is merely superstitious nonsense. However, the moth-proofing of fabrics, which involves immersing them in various insecticide solutions either during the dyeing process or subsequently, was not developed until the twentieth century. Knowing this, one can better appreciate Keat's meaning in The Fall of Hyperion (I.75) wherein he wrote that he awakened in a dream in an old sanctuary and saw:

> "Upon the marble at my feet there lay
> Store of strange vessels and large draperies,
> Which needs had been of dyed asbestos wove,
> Or in that place the moth could not corrupt,".

Pests of another kind are those species of moths which attack cereal products such as flour. One of these is

the Mediterranean flour moth, Ephestia kuehniella Zell., whose larvae are great pests in flour mills. Probably this is the insect alluded to in the old English folk rhyme which runs:

"Millery, millery, dusty poll,
How many zacks hast thee astole?
Vour and twenty an' a peck,
Hang the miller up by 's neck."

In country districts in England, as also in parts of North America, the word "miller" is frequently used in place of "moth".

Among the numerous kinds of moths that fly in English gardens at dusk or after dark are several species of rather large size with compact bodies and powerful wings, which in general conformation somewhat resemble the modern pursuit plane. These are called hawk or sphinx moths, and they develop from large, rather smooth-skinned caterpillars which bear a spine or horn at the tail end, a feature that has earned them the name of hornworms. The powerful flying powers of these moths enable them to hover over flowers and, without alighting, extract the nectar through their long, flexible tube-like mouthparts. George Crabbe, an eighteenth century English poet of rural life wrote of the:

"... hungry sphinx, who threads the honeyed flower;
She o'er the larkspur's bed, where sweets abound,
Views every bell and hums the approving sound."

The approving sound, of course, is made by the rapidly vibrating wings. One of these species, Acherontia atropos, bears the gruesome name of the death's head moth, and is one

of the largest found in England, measuring about five inches from tip to tip of the expanded wings. It received its name because of the scale pattern on the thorax which has a resemblance to a skull and crossbones. Thomas Hood alluded to it for spooky atmosphere in The Haunted House:

"And on the wall, as chilly as a tomb
The death's-head moth was clinging."

This moth is unusual in several other respects. It has been noted entering bee-hives of the "old straw-skep pattern", to rob the bees of their honey. It is also capable of making a shrill squeaking sound. The larva, too, makes a "cracking" sound when annoyed, by clashing together its mandibles. It commonly feeds on the foliage of potato and related plants.

Another moth with an uncanny name is the ghost moth, Hepialus humuli, which belongs to a family of very fast fliers. The male of this species is white and is sought after by the female instead of vice versa. The moths fly in the evening, at or before dusk. The males sway to and fro without making progress, as if suspended in mid-air, and the females fly straight towards them seeking a mate. Alexander Smith wrote of this species:

"And o'er the darkening heath and wold
The large ghost moth doth flit."

It has a wide distribution in the British Isles, the caterpillars feeding on the roots of weeds such as burdock and dandelion. Kirby and Spence have recorded that in the north

and west of England, moths which fly into candles used to be called "saules", perhaps because of an old belief that the souls of the dead fly about at night seeking a light. They also mentioned that, probably for the same reason, such moths were often called "Geistchen" (ghosts) in Germany.

W.B. Yeats alluded to white moths in The Song of Wandering Aengus, but doubtless a different species was meant.

"I went out to the hazel wood,
Because a fire was in my head,
And cut and peeled a hazel wand,
And hooked a berry to a thread;
And when white moths were on the wing,
And moth-like stars were flickering out,
I dropped the berry in a stream
And caught a little silver trout."

Alfred Noyes may have been referring to the magpie moth, Abraxas grossulariata, the larvae of which are a serious pest of currants and gooseberries in English gardens, when he described how:

"... luxuriating in heat,
With slow and gorgeous beat,
White-winged currant-moths display
Their spots of black and gold all day."

As this description indicates, not all moths are drab-coloured. Indeed, many of them rival butterflies in the brilliance of their colour patterns. The stout-bodied tiger moths frequently have their rather broad wings spotted or banded with bright colours. Keats makes use of this feature in a description in St. Agnes of:

"... casements high and triple arch'd--
All garlanded with carven imag'ries
Of fruits, and flowers, and bunches of knot-grass,
And diamonded with panes of quaint device,
Innumerable of stains and splendid dyes,
As are the tiger-moth's deep damask'd wings;".

The larvae of the tiger moths are densely covered with long hairs, a characteristic which has earned them the name of bear-worms, or woolly-bears. The hairs are used by the larvae in constructing their cocoons prior to pupation. Tennyson, too, showed familiarity with lovely coloured moths in The Princess (II.19), when he wrote that the college portress brought:

"... academic silks, in hue
The lilac, with a silken hood to each,
And zoned with gold; and now when they were on,
And we as rich as moths from dusk cocoons,"

she "let us know the Princess Ida waited".

Primitive peoples are known to eat the caterpillars and also the bodies of moths, which are said to have a nut-like flavour. Undoubtedly they would be nourishing and, when properly cooked and served, should be no less palatable than some of the crustaceans considered delicacies and commonly eaten with relish. According to the poets Herrick and Keats, the fairies look upon moths as edible dainties. One of the items on the abundant menu at the fairies' feast enjoyed by King Oberon in Herrick's Hesperides was:

"... a little moth
Late fatten'd in a piece of cloth,"

and thus obviously a clothes moth. Crafticant, in Keat's

poetical fairy tale, The Cap and Bells, records in his diary that he, at:

> "Five minutes before one - brought down a moth
> With my new double-barrel - stew'd the thighs
> And made a very tolerable broth--
> Princess turned dainty;--to our great surprise,
> Alter'd her mind, and thought it very nice:".

No discussion of moths would be complete without reference to that extremely important benefactor of the human race, the silkworm, called by entomologists Bombyx mori L. In the opinion of Burr (9, p.258), in "The Insect Legion", "No other insects, except the distributors of disease have had so great an influence upon humanity, even though the culture of silkworms must be restricted to lands where the white mulberry will grow and labour is cheap." Many allusions to silk and silken goods are to be found in the works of the poets and dramatists, and a few refer to the insect itself. Chaucer did not mention the silkworm, but Tatler and Kennedy's Concordance lists fifteen references to silk in his works, of which the following: "A ceynt she werede, y-barred al of silk", is typical. Phipson (46, p.426) quotes the following lines from Chester's Love's Martyr (p.116):

> "The Silkeworme by whose webbe our silkes are made,
> For she doth dayly labour with her weaving,
> A worme that's rich and precious in her trade,
> That whilst poore soule she toyleth in her spinning
> Leaves nothing in her belly but empty aire,
> And toyling too much falleth to despaire."

The silkworm's silk does not originate "in her belly", but is secreted by silk glands appended to the digestive system

and homologous with the salivary glands of other insects. These glands are so long (four times the length of the larva) that in order for the body to contain them they are folded around the hinder part of the intestine. The silk is spun through the mouthparts. The silkworm might well despair, however, for many centuries of domestication have degenerated its larval legs, and removed from the moth the power to fly, so that now it would seem to be entirely dependent on man for its continued existence, and is no longer to be found in nature.

Shakespeare mentioned the silkworm in Othello (III.4). This was when Othello, stressing the importance he placed on the return of his mother's handkerchief by his wife, said of it that:

"The worms were hallow'd that did breed the silk;".

In a protest Against Pride in Clothes (III) Isaac Watts wrote:

"How proud we are! how fond to shew
Our clothes, and call them rich and new.
When the poor sheep and silkworm wore
That very clothing long before."

In a sense the silkworm actually does wear the silk before it is utilized by man, for it is woven into the cocoon that protects the insect during the pupal period, and from which man's supply is obtained. As Pope pointed out:

"So opens the silk-worm small its slender store,
And labours till it clouds itself all o'er."

The poet Milton wrote of the silkworm, in Comus:

"Wherefore did Nature pour her bounties forth

. . . . .

"And set to work millions of spinning worms,
That in their green shops weave the smooth-haired silk
To deck her sons;".

Shelley, in the following lines from his Letter to Maria Gisborne likened himself to a silkworm spinning a cocoon of poetical silk to protect and preserve his memory and immortalize his name.

"The silk-worm in the dark-green mulberry leaves
His winding sheet and cradle ever weaves;
So I, a thing whom moralists call worm,
Sit spinning still round this decaying form,
From the fine threads of rare and subtle thought--
No net of words in garish colours wrought
To catch the idle buzzers of the day--
But a soft cell, where when that fades away,
Memory may clothe in wings my living name
And feed it with the asphodels of fame,".

Erasmus Darwin described the life-history of the silkworm in The Temple of Nature. The latter part of this description was based on a misconception, for, as pointed out by W.R. Walton (60) the moth takes little or no nourishment and is incapable of fligh

"Erewhile the changeful worm with circling head
Weaves the nice curtains of his silken bed;
Web within web involves his larva form,
Alike secured from sunshine and from storm;
For twelve long days he dreams of blossom'd groves,
Untasted honey, and ideal loves.
Wakes from his trance, alarmed with young desire,
Finds his new sex, and feels ecstatic fire;
From flower to flower, with honeyed lip he springs,
And seeks his velvet loves on silver wings."

Nowadays, the invention and development of various excellent substitutes have rendered real silk much less essential in the manufacture of clothing and other fabrics than in past times, but nevertheless, the silkworm and its product is still valuable and important for many purposes.

CHAPTER VII

Order Coleoptera: The Beetles

The name of this order, Coleoptera, is from the Greek: koleon, a sheath, and ptera, wings; the insects with sheathed wings. Typically the beetles are four-winged. The front pair of wings are horny or leathery and when the insect is not in flight meet along the middle of the back to cover the membranous hind wings: they also serve as protective armour for the body. In some species the hind wings are lacking and the fore wings or elytra may be fused together, and in a few others both pairs of wings are absent. E.V. Lucas, in The Three-Halfpenny Traveller, with poetic licence likened the thickness of a postage stamp to that of a beetle's wing:

"A stamp's a tiny, flimsy thing,
No thicker than a beetle's wing,
And yet t'will roam the world for you
Exactly where you tell it to."

The mouthparts of beetles, both adults and larvae, are adapted for chewing. They have a complete metamorphosis. More than a quarter of a million species have been described by taxonomists, and probably a great many others are still unknown to science. They vary greatly in size, and measure in length from less than one-fiftieth of an inch, to slightly more than six inches; some of the smallest and some of the

largest of insects. In fact, the largest of the beetles is larger than the smallest of mammals, and the smallest is smaller than the largest protozoa. The various species or groups of species vary widely in habits and in their choice of food. Many of them are more or less harmless, while others range from minor pests to pests of great importance. Still others are beneficial because they prey on other insects.

Family Carabidae: The Ground Beetles.

This family of many species is an important one because a majority of its members are carnivorous both in the larval and adult form and prey on other insects. The larvae are elongate, active creatures, armed with a pair of pincer-like mandibles. They live an obscure life and are consequently less often seen than the adults. The beetles themselves are mostly plain black or brown in colour and may be observed running through the grass, or hiding under rubbish or stones. Many of them are incapable of flight, the elytra or first pair of wings being fused together, and the second pair atrophied. Others fly by night. It was undoubtedly one of the ground beetles that Carlyle referred to in the following lines:

"Poor hobbling Beetle, needst not haste;
Should traveller traveller thus alarm?
Pursue thy journey through the waste,
Not foot of mine shall work thee harm.
Who knows what errand grave thou hast,
'Small family'--that have not dined?
Lodged under pebble, there they fast,
Till head of house have raised the wind!"

Carlyle's impulse not to kill the beetle was a sound one in view of the insect's beneficial nature, but not for the sentimental reason that he gave. The "small family" could only consist of the larvae, which are very capable of finding their own food and do not depend on parental efforts. Some of these beetles and their offspring have been referred to as caterpillar hunters, and at least one species, Calosoma sycophant L., owing to its prowess in this regard was imported from Europe into North America in large numbers some years ago, to assist in controlling the caterpillars of the gypsy and brown-tail moths which are serious pests of forest and shade trees.

It was probably a ground beetle that Shakespeare had in mind in the passage in Measure for Measure (III.1), wherein he indicates that death is as painless for man as for the lowly beetle. Isabella fearing that her brother Claudio may quail in fear of death and prefer dishonour, tries to reconcile him to an honourable fate by saying:

> "O, I do fear thee, Claudio; and I quake,
> Lest thou a feverish life should'st entertain,
> And six or seven winters more respect
> Than a perpetual honour. Dar'st thou die?
> The sense of death is most in apprehension;
> And the poor beetle, that we tread upon,
> In corporal sufferance finds a pang as great
> As when a giant dies."

Doubtless a ground beetle was also meant in King Lear (IV.6), when Edgar said to his sightless father, the Earl of Gloucester, that so high was the Dover Cliff on which they stood that:

> "The crows and choughs that wing the midway air,
> Show scarce so gross as beetles:".

THE CALOSOMA BEETLES

BOTH THE LARVAE AND ADULTS ARE NATURAL ENEMIES OF THE GIPSY MOTH

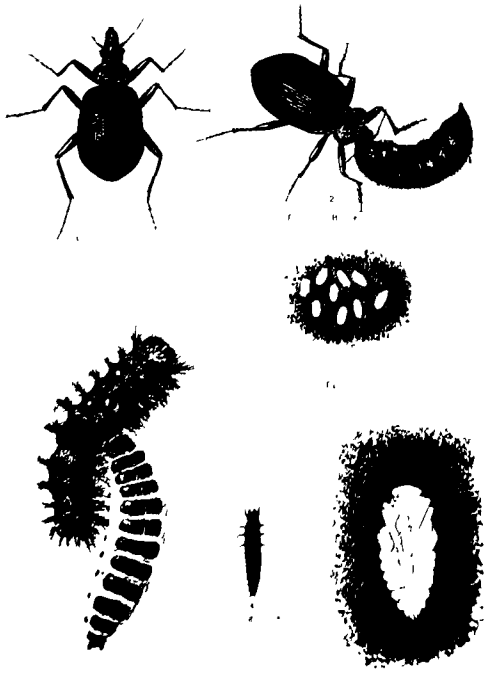

PLATE IV

- Above: burying beetles attracted to dead bird (natural size). Left: ground beetles, Calosoma spp., and life-stages attacking gypsy moth larva and pupa.

An interesting feature worthy of mention about certain species in this family is the ability of the beetles when attacked to discharge an ill-smelling caustic fluid from the hind end of the body in the direction of the attacker. In the so-called bombardier beetles (Brachinus spp.) this fluid suddenly changes into a gas on contact with air and becomes visible as a tiny puff of vapour, accompanied by an audible pop. These beetles might be considered the original artillerymen.

Family Staphylinidae: The Rove Beetles.

The rove beetles are slender, elongate beetles characterized by very short wing-covers (elytra), which nevertheless conceal skilfully folded, well-developed and effective wings. There are numerous species most of which frequent decaying organic matter and prey on other insects. Thanks to its abbreviated wing covers, the rove beetle when alarmed can raise its abdomen in a threatening manner like a scorpion about to sting, and this has earned it the title of "the devil's coach-horse". Only one certain reference to it by the poets has come to hand, and that by Owen Meredith (Lord Bulwer Lytton) which runs:

"The toad told the Devil's Coach-Horse,
Who cocked up his tail at the news."

Evidently the news was bad and startled the poor creature. However, among the guests at William Roscoe's Butterfly's

Ball and the Grasshopper's Feast:

"... there came the Beetle
So blind and so black,
And carried the Emmet,
His friend on his back."

Perhaps this was one of the myrmecophilous rove beetles, which normally live as guests in ants' nests, attempting to repay his host's hospitality. Actually, of course, it is only an example of poetic licence, for the lively ant would not willingly tolerate such a method of transportation.

Family Coccinellidae: Ladybird Beetles.

"Ladybird, ladybird, fly away home,
Your house is on fire, your children will burn."

The subject of this homely little rhyme, which has been repeated by generations of English children down the centuries, is a group of little hemispherical beetles red or yellow in colour with black spots, or black with red or yellow spots. These little beetles and their active larvae are very useful to man for they are carnivorous and prey on aphids and other soft-bodied insects. Lutz (34, p.298) suggests that the word ladybird goes back to the Middle Ages when the insects were dedicated to the Virgin and were known as "the beetles of Our Lady". If this is so, it may have been in recognition of their beneficial role in destroying injurious pests.

The ladybird has featured in a number of English rhymes, sometimes under other names. For instance, Drayton called the little beetle a "lady-cow" in The Muses Elizium:

"They shall be of the lady-cow,
The dainty shell upon her back,
Of crimson strewed with spots of black."

Under this name in English folk rhymes, the ladybird was supposed to have the power to direct little girls to their sweethearts (vide Northall). The beetle would be tossed up in the air from the back of the child's hand while she chanted:

"Ladycow, ladycow, fly from my hand,
Tell me where my true love stands,
Up hill, or down hill, or by the sea-sand,
Ladycow, ladycow, fly from my hand."

Another version of this was given in The Shepherd's Week by John Gay in the early eighteenth century:

"This lady-fly I take from off the grass,
Whose spotted back might scarlet red surpass,
'Fly, lady-bird, north, south, or east, or west,
Fly where the man is found that I love best'."

In Sussex, the beetle, under the alias of Bishop Barnabee, was asked to go still further and set the date of the wedding, thus:

"Bishop, Bishop Barnabee,
Tell me when my wedding shall be,
If it be tomorrow day,
Ope' your wings and fly away."

Family Lampyridae: The Fire-flies and Glow-worms.

"The Fire-flies flit, and swarm, and throng,
Till all the mountain depths are spangled."

Faust (II): Shelley.

"Glories, like glow-worms, afar off shine bright,
But look'd too near have neither heat nor light."

The White Devil (IV.4): Webster.

The tiny mysterious lights that flit and wink in garden and countryside during warm summer nights are produced by beetles

of the family Lampyridae, nearly all of which possess photogenic organs. They are insects of medium or small size with bodies and wing-covers softer than is usual for beetles, and the fore part of the thorax expanded in a thin margin which conceals the head. Concerning the location of the light-producing organs, Cowper wrote:

"Disputes have been and still prevail,
From whence his rays proceed;
Some give that honour to his tail,
And others to his head."

- The Glow-worm.

There seem to have been no doubts on this matter in the mind of Michael Drayton a century and a half earlier, for he wrote that when fairy King Oberon lost his queen and thought she had been stolen by Pigwiggen, he set out in a terrible temper to find him. After scaring the wits out of a wasp:

"He next upon a glow-worm light,
(You must suppose it now was night)
Which, for her hinder part was bright,
He took her for a devil,
And furiously doth her assail
For carrying fire in her tail;
He thrashed her rough coat with his flail,
The mad king feared no evil."

Drayton, of course, was right, the organs in question are in the tail, or more correctly in the hinder segments of the abdomen. Both adults and larvae have the faculty of producing light, and even the eggs are luminous. This light, which is usually pale yellowish green, results from the oxidation of a compound called luciferin in the presence of an enzyme-like substance luciferase, practically without producing heat

(30, p.105). The probable function of this luminescence in the adult beetles is sex attraction, as romantically explained by James Montgomery:

"When evening closes Nature's eye,
The glow-worm lights her little spark,
To captivate her favorite fly,
And tempt the rover through the dark.

"Conducted by a sweeter star
Than all that deck the field above,
He fondly hastens from afar,
To soothe her solitude with love."

It should be mentioned that the females of some species of Lampyridae are wingless and constitute the "glow-worm" of the poem. The larvae, too, are called by this name. The winged males and females are the "fire-flies".

A good proportion of the allusions probably refer to the common European species, Lampyris noctiluca, the female of which is larviform and without wings. That Shakespeare knew of it is shown in several of his works. In Hamlet (I.5), for example, the Ghost emphasizes the urgency of his departure on the approach of morning by saying to Hamlet:

"Fare thee well at once!
The Glow-worm shows the matin to be near,
And 'gins to pale his uneffectual fire:
Adieu, adieu! Hamlet, remember me."

And in Midsummer Night's Dream (III.1) the bewitched Titania orders her fairies to feed and take care of Bottom and to this end to:

"Steal from the humble-bees,
And for night-tapers crop their waxen thighs,
And light them at the fiery glow-worm's eyes,"

a quite impossible task in view of the heatless nature of the glow-worm's light, which, as already pointed out, is in the abdomen, not the eyes. One other allusion is to be found in Venus and Adonis (L.103), in the vivid and horrific description of the wild boar given by Venus in her anguished efforts to dissuade Adonis from taking part in the hunt.

"On his bow-back he hath a battle set
Of bristly pikes, that ever threat his foes;
His eyes like glow-worms shine when he doth fret;
His snout digs sepulchres where'er he goes;".

John Lyly, in his Epilogue to Campaspe, mentioned the glow-worm when repeating a baseless, and probably ancient, superstition to the effect that:

"where the glow-worme creepeth in the night
no adder will goe in the day."

Some allusions to the glow-worm and fire-fly in English poetry and drama undoubtedly refer to species common in warmer parts than England, such as in the Mediterranean region. This applies to most of the references found in the works of Shelley, Byron and Browning, all of whom spent part of their lives in Italy. However, the following from Shelley's To a Skylark may relate to an English species:

"... a glow-worm golden
In a dell of dew,
Scattering unbeholden
Its aerial hue
Among the flowers and grass which screen it
From the view:".

William Cowper wrote a charming poem in which an English glow-worm played a leading role. This short poem, entitled

The Nightingale and the Glow-worm, is worth repeating in its entirety because of the beauty of its sentiment:

"A nightingale, that all day long
Had cheered the village with his song,
Nor yet at eve his note suspended,
Nor yet when eventide was ended,
Began to feel, as well he might,
The keen demands of appetite.
When, looking eagerly around,
He spied far off, upon the ground,
A something shining in the dark,
And knew the glow-worm by his spark;
So, stooping down from hawthorne top,
He thought to put him in his crop.
The worm, aware of his intent,
Harangued him thus, right eloquent--
'Did you admire my lamp', quoth he,
'As much as I your minstrelsy,
You would abhor to do me wrong
As much as I to spoil your song.
For 'twas the selfsame power divine,
Taught you to sing, and me to shine;
That you with music, I with light,
Might beautify and cheer the night'.
The songster heard his short oration,
And warbling out his approbation,
Released him, as my story tells,
And found a supper somewhere else."

Of course, unless the glow-worm was a larva and therefore of either sex, the poet's specimen would have been a female and not a male, as indicated in the poem. If it were a larva, it was not appealing to the nightingale for clemency on the basis of "do unto others as you would have them do unto you". For these creatures are carnivorous and feed upon slugs and snails, seizing the unfortunate molluscs with sharp pincer-like mandibles.

The works of Keats contain four allusions to the glow-worm, of which two are given here. In Endymion (II.141) he wrote that:

"... beneath the evening's sleepy frown
Glow-worms began to trim their starry lamps,"

and in Cap and Bells (XXIV.9) pointed out that the gaslights of the retail merchants repel the powers of darkness,

"And supersedeth quite the use of the glow-worm".

In his well-known Scorn Not the Sonnet, Wordsworth likened the sonnet to a glow-worm lamp:

"The sonnet glittered a gay myrtle leaf
Amid the cypress with which Dante crowned
His visionary brow; a glow-worm lamp,
It cheered mild Spenser, called from Faery-land
To struggle through dark ways;".

In An Evening Walk, Wordsworth wrote of a swan with young, that:

"Oft has she taught them on her lap to lay
The shining glow-worm; or in heedless play,
Toss it from hand to hand, disquieted;
While others, not unseen, are free to shed
Green unmolested light upon their mossy bed."

A further allusion is in The Primrose of the Rock:

"A Rock there is whose homely front
The passing traveller slights;
Yet there the glow-worms hang their lamps,
Like stars at various heights;".

Tennyson apparently was interested in the lampyrids only in the function of similitudes, if one is to judge from the following quotations:

"... the Pleiads, rising thro' the mellow shade,
Glitter like a swarm of fireflies tangled in
a silver braid."

- Locksley Hall.

"... below
No bigger than a glow-worm shone the tent
Lamp-lit from the inner."

- The Princess (IV.25)

"And the glow-worm of the grave
Glimmer in thy rheumy eyes."

- The Vision of Sin (153)

Several English poets have written about exotic forms of the fire-fly beetles. In the Mediterranean region both sexes are winged and, contrary to what one would expect, the light of the male is more brilliant than that of the female. Doubtless Shelley and Browning were writing of southern European species in the following. The first two quotations are from Shelley:

"In circles quaint, and ever-changing dance,
Like winged stars the fire-flies flash and glance
Pale in the open moonshine, but each one
Under the dark trees seems a little sun,
A meteor tamed; a fixed star gone astray
From the silver regions of the milky way."

- Gisborne (279-285)

But when daylight came the:

"Fireflies were quenched on the dewy corn,
Glow-worms went out on the river's brim,
Like lamps which a student forgets to trim:".

- The Boat on the Serchio.

As one of the attractions up at the villa, Robert Browning wrote that:

"Some think fireflies pretty, when they mix
i' the corn and mingle,
Or thrid the stinking hemp till the stalks
Of it seem a-tingle."

- Up at the Villa - Down in the City.

The fire-flies of the East Indies were observed by Sir Francis Drake in the latter part of the sixteenth century.

This is described in Hakluyt's Voyages, in "The Famous Voyage of Sir Francis Drake into the South sea, and therehence about the whole Globe of the earth, begun in the yeere of our Lord, 1577", as quoted by Weiss*:

> "Our General considering the great distance, and how farre he was yet off from his Countrey, thought it not best here to linger the time any longer, but waying his anchors, set out of the Island, and sayled to a certaine little Island to the southwards of Celebes, where he graved our ship, and continued there in that and other businesses 26 dayes. This Island is thoroughly growen with wood of a large and high growth, very straight and without boughes, save onely in the head or top, whose leaves are not much differing from our broome in England. Amongst these trees night by night, through the whole land, did shew themselves an infinite swarm of fiery wormes flying in the ayre, whose bodies beeing no bigger than our common English flies, make such a shew and light, as if every twigge or tree had bene a burning candle."

These may be the kind sometimes referred to as "lantern-flies", a name which has also been used in the West Indies. A description of them by Champlain in his account of a voyage to the West Indies and Mexico in 1599 was quoted from Hakluyt by Phipson (46, p.403):

> "There is a kind of little animal of the size of prawnes, which fly by night, and make such light in the air that one would say that they were so many little candles. If a man had three or four of these little creatures, which are not larger than a filbert, he could read as well at night as with a wax light."

When Sir Thomas Cavendish and Sir Robert Dudley first landed in the West Indies they saw (vide Mouffet) in the evening a great number of moving lights in the wood. These,

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*Weiss, H.B. Jour. N.Y. Ent. Soc. Vol. 34, p.190, 1926.

of course, were fire-flies, but due to their ignorance of such insects, the Englishmen took them for Spaniards advancing upon them and withdrew to their ships. Southey has described the spectacle presented by these luminous nocturnal fliers in the following verse:

> "... Sorrowing we beheld
> The night come on; but soon did night display
> More wonders than it veil'd: innumerous tribes
> From the wood-cover swarm'd, and darkness made
> Their beauties visible: one while they stream'd
> A bright blue radiance upon flowers that closed
> Their gorgeous colours from the eye of day;
> Now motionless and dark, eluded search,
> Self-shrouded; and anon, starring the sky,
> Rose like a shower of fire."

Family Anobiidae: The Death-Watch Beetles.

> "These dull abortive sounds that fret the silence
> With puny thwartings and mock opposition!
> So beats the death-watch to a sick man's ear."
>
> - Remorse (IV.1): Coleridge.

Many of the species in this family are borers in dry wood, both as adults and larvae, and certain of them at times cause serious damage to woodwork in houses and furniture. In general they are rather small, cylindrical or oval-shaped beetles. The species usually referred to as the "death-watch" is Xestobium rufovillosum DeG., although the name is also applied to allied forms. The ticking of the death-watch is caused by the beetles in their burrows tapping their heads against the wood. It occurs in the spring months and apparently is a sexual call, but among the superstitious has been taken as a forewarning of the approaching death of a member of the

household. Thus, Thomas Campbell in the Dirge of Wallace:

"And the lady of Elderslie wept for her lord
When a death-watch beat in her lonely room,
When her curtain had shook of its own accord;
And the raven had flapped at her window-board,
To tell of her warrior's doom!"

And Keats in Endymion (IV.531):

"... within ye hear
No sound so loud as when on curtain'd bier
The death-watch tick is stifled."

Tennyson, too, made several allusions to the death-watch with telling effect. For instance, in Forlorn:

"You that lie with wasted lungs
Waiting for your summons...
In the night, O the night!
O the death-watch beating!"

Again in Queen Mary, he referred to:

"Nights in the Tower; dead--with the fear of death--
Too dead ev'n for a death-watch;"

and, in the pathetic Conclusion of The May Queen, he put into the mouth of the dying girl the following words with their message of hope:

"I did not hear the dog howl, mother, or the death-watch beat
There came a sweeter token when the night and morning meet:"

. . . . .

"All in the wild March-morning I heard the angels call;
It was when the moon was setting, and the dark was over all;

The death-watch beetles are likely to be most numerous in very old houses, of which there are many in England, and in such places goblins and ghosts might be expected to lurk by those who believe in or fear the supernatural. Such a place, wit

"Haunted old rooms...
Where death-ticks knock and mouldering panels glow,"

was described by Masefield in The Death Rooms.

The rational intellect of Dean Swift would have none of this superstition, and more than two-hundred years ago he poked fun at it in verse and revealed its cause and suggested a cure. He described the death-watch as:

"... a wood-worm
That lies in old wood, like a hare in her form:
With teeth or with claws it will bite or will scratch,
And chambermaids christen this worm a death-watch:
Because like a watch it always cries click:
Then woe be to those in the house who are sick!
For, sure as a gun, they will give up the ghost,
If the maggot cries click, when it scratches the post;
But a kettle of scalding hot water ejected,
Infallibly cures the timber affected:
The omen is broken, the danger is over,
The maggot will die, and the sick will recover."

There are other species of beetles besides the death-watch which tunnel in wood products. Among them are the so-called powder post beetles (family Lyctidae) which cut cylindrical burrows in dried wood, reducing it to powder in the process. Sometimes they may not be discovered until the wood is ready to collapse, but usually their presence is revealed by the fine "sawdust" ejected from their exit holes. In the following selections the allusions may concern one or more of several wood-boring species.

The decrepit tavern which Tennyson's Enoch Arden sought down by the quays had:

"A front of timber-crost antiquity,
So propt, worm-eaten, ruinously old,
He thought it must have gone;".

And Thomas Hardy commented bitterly in An Ancient to Ancients:

"Where once we danced, where once we sang,
Gentlemen,
The floors are sunken, cobwebs hang,
And cracks creep; worms have fed upon
The doors. Yea, sprightlier times were then
Than now, with harps and tablets gone,
Gentlemen!"

Many people have a favourite easy chair. Thackeray's was an old cane-bottomed one which he commemorated in verse. It was of more value to him than "the finest of couches that's padded with hair", in spite of the fact that:

"'Tis a bandy-legged, high-shouldered, worm-eaten seat,
With a creaking old back and twisted old feet;".

The tragic story of the awful chest which trapped the young bride with its spring-lock when she prankishly hid in it from her husband on her wedding day, so that she disappeared forever from his ken, is described in Samuel Rogers poem, Ginevra. Long after her disappearance her picture still hung:

"Over a mouldering heirloom, its companion,
An oaken chest, half eaten by the worm,"

and the despairing husband had long since gone to war and been killed in battle:

"Full fifty years were passed, and all forgot,
When on an idle day - a day of search
'Mid the old lumber in the gallery,
That mouldering chest was noticed; and t'was said
By one as young, as thoughtless as Ginevra,
'Why not remove it from its lurking place?'
T'was done as soon as said; but on the way
It burst, it fell; and lo! a skeleton."

Thus, the grave of the unfortunate bride was revealed by the beetles' destructive work.

The family Anobiidae includes certain species of beetles that are also destructive to books. There are several allusions in the works of the poets to "book-worms" and "moths" damaging books and manuscripts. In Spenser's Faerie Queene (II.9.57), Sir Guyon's host, the "Old Man Eumnestes", was described as older than "Mathusalem" and:

> "His chamber all was hangd about with rolls
> And old records from auncient times derivd,
> Some made in books, some in long parchment scrolls,
> That were all worm-eaten and full of canker holes."

According to an account in Wallace's "Life and Works of Burns" (p.308), the latter once on visiting a nobleman was shown into the library where he found a beautifully bound, but apparently unread, copy of Shakespeare badly worm-eaten. He thereupon penned the following epigram and inserted it in the book, where it was found long after his death.

> "Through and through th' inspired leaves
> Ye maggots, make your windings;
> But O, respect his lordship's taste,
> And spare the golden bindings!"

Besides beetles and their larvae, the primitive insects known as silverfish, Lepismidae, which belong to a different order, often damage books and papers, as they are fond of materials containing starch and glue. Perhaps the word "moth" in Burn's Epistle to James Smith refers to them:

> "There's ither poets, much your betters,
> Far seen in Greek, deep men o' letters,
> Hae thought they had ensur'd their debtors,
> A' future ages;
> Now moths deform, in shapeless tatters
> Their unknown pages."

A somewhat similar allusion occurs in Pope's Essay on Criticism:

"Some on the leaves of ancient authors prey,
Nor time nor moths e'er spoiled so much as they;".

Family Chrysomelidae: The Leaf-Beetles.

The leaf-beetles, which comprise an extensive and economically important family, appear to have been largely overlooked in English poetry and drama. This is somewhat surprising as they are found feeding on the leaves of a wide range of plants and include in their number some very injurious pests. A familiar example in North America is the Colorado potato beetle, Leptinotarsa decemlineata Say, a chunky, oval shaped beetle with yellow wing-covers striped with black. Before the arrival of the white man this species was confined, until about 1855, to the southern Rocky Mountain region, where it fed on wild plants related to the potato. With the establishment and spread of potato culture man provided the beetle with an unlimited food supply, and it spread eastward throughout the United States and Canada. Subsequently it found its way through commerce to several localities on the European continent where its advent was greatly feared. It has not yet gained a footing in England, where restrictive legislation is enforced to prevent its introduction. Burr (9, p.188) records, however, that following a potato beetle scare some fifty years ago it was caricatured on the English stage. This was in a pantomime played in 1887 in the provinces. Burr states that "the Demon

King came on to the stage dressed in black and yellow stripes, the appropriate livery, and sang:

"Take care of your little potatoes, boys!
And all your tiny spuds.
Just watch your jolly cauliflowers
And all your fuchsia buds.
You'd better hide your bread and cheese,
And everything you've got,
For the Colorado beetle's come,
To collar the jolly lot!"

Family Curculionidae: The Weevils.

This family, also, is very large and includes probably more than 30,000 described species in the world, of which a number, such as the grain weevils and various species that bore into trees, roots, blossoms, fruits, etc., are responsible for great damage and loss. A distinctive characteristic of all weevils is the prolongation of the head into the form of a snout or beak which has earned them another popular name, to wit, snout beetles. This snout is often used to bore holes in which to deposit the beetles' eggs. The snout of the curculios which attack nuts is long and slender. The legless, maggot-like larvae feed on the nut kernels.

Shakespeare may have referred to the work of one of these species in As You Like It (III.4). Celia, when Rosalind was distressed because her lover Orlando had not come to her in the forest, unkindly remarked that:

"for his verity in love, I do think him as a
covered goblet or a worm-eaten nut."

Or, in other words, worthless. In a rather ill-chosen simile

Keats likens the curculio larva to a scorpion. This is in Otho the Great (V.5.156), wherein Ludolph says of his wife:

> "Even as the worm doth feed upon the nut,
> So she, a scorpion, preys upon my brain."

When infested nuts fall to the ground from the trees, the curculio grubs leave them and burrow into the earth, where they pass the winter and pupate and emerge as adult beetles the next summer. This was evidently not known to Erasmus Darwin, as may be seen by scanning the following lines from one of his poems:

> "So sleeps in silence the Curculio, shut
> In the dark chamber of the cavern'd nut;
> Erodes with ivory beak the vaulted shell,
> And quits on filmy wings its narrow cell."

Actually, the beetle never occurs inside the nut and, moreover, its beak is not ivory, but black.

Family Lucanidae: The Stag Beetles.

The rather odd popular name of the beetles in this family derives from their very large mandibles (jaws), which in certain species are branched somewhat like the antlers of a stag. The flattened, whitish grubs thrive in decaying wood and, in some species at least, persist for several years before pupating in a cell made up of the coarse "sawdust" from their gnawings. In view of the formidable appearance of the head of the stag beetle with its massive jaws, it may have been one of these that Pigwiggen wore as a helmet when setting forth on chivalrous adventure, as described by Michael Drayton in

The Court of Fairy:

"His helmet was a beetle's head,
Most horrible and full of dread,
That able was to strike one dead,
Yet it did well become him;
And for a plume a horse's hair,
Which being tossed up by the air,
Had force to strike his foe with fear,
And turn his weapon from him."

Perhaps one of the functions of these large mandibles is to strike fear into the enemies of the beetle, because the greater their size is, the less efficient they seem to be for biting purposes.

Family Scarabaeidae: Chafers, Scarabs, June Beetles, etc.

"The scaly beetles with their habergeons,
That make a humming murmur as they fly."
The Sad Shepherd (II.2): Ben Jonson.

The species in this large family of beetles vary considerably in size, appearance and habits. Typically, however, they are rather stout-bodied insects with wing covers (elytra) which do not quite cover the abdomen. Familiar examples are the cockchafers or June beetles which are often common in the spring and fly blunderingly past one in the dusk or come tap-tap-tapping at the lighted windows. Perhaps it was one of these that De La Mare wrote of in The Ravens Tomb:

"Summon the haunted beetle,
From twilight bud and bloom,
To drone a gloomy dirge for me
At dusk above my tomb."

An English local name for the European cockchafer, Melolontha

vulgaris, is "buzzard-clock". Tennyson used it in Northern Farmer, Old Style, in the following lines wherein the farmer describes the parson's sermon in rather uncomplimentary terms in northern English dialect:

"An' I hallus coom'd to 's choorch afoor moy Sally wur deäd,
An' 'eärd 'um a bummin' awäy loike a buzzard-clock ower my 'eäd
An' I niver knaw'd whot a meän'd but I thowt a 'ad summut to säy
An' I thowt a said whot a owt to 'a said an' I coom'd awäy."

The stoutish grubs of these beetles spend three years in the soil where they feed on the roots of pasture grasses and cultivated crops, often causing important damage. The beetles themselves feed on the foliage of deciduous trees.

A closely allied group are the dung beetles, called "dor" beetles in England. A well-known species is Geotrupes sterorarius L. They dig tunnels in the earth either under or near animal excrement, and place a plug of the latter in the bottom of each and lay an egg in it. The dung serves as food for the grubs. These beetles are large and rounded in form, and produce a humming sound in their clumsy flight. Kirby and Spence (31, p.221) suggest that this is the "shard-borne beetle" referred to by Shakespeare. The allusion occurs in Macbeth (III.2), when the latter tells Lady Macbeth that although Banquo and his son Fleance still live, "There's comfort yet; they are assailable;" .... and:

> "Ere the bat hath flown
> His cloister'd flight; ere to black Hecate's summons
> The shard-borne beetle, with his drowsy hums,
> Hath rung night's yawning peal, there shall be done
> A deed of dreadful note."

Thomas Gray, in the second stanza of his famous Elegy Written in a Country Churchyard, also mentions this species.

"Now fades the glimmering landscape on the sight,
And all the air a solemn stillness holds,
Save where the beetle wheels his droning flight,
And drowsy tinklings lull the distant folds;".

The cockchafer is evidently a familiar creature in England, for several other poets have alluded to it. Indeed, the entomologists Kirby and Spence recorded that it may "be heard in all places almost every fine evening in summer". Gray's contemporary, William Collins, referred to the above or an allied species in this fine descriptive verse from an Ode to Evening:

"Now air is hush'd save where the weak-eyed bat,
With short shrill shriek, flits by on leathern wing,
Or where the beetle winds
His small but sullen horn,
As oft he rises 'midst the twilight path,
Against the pilgrim borne in heedless hum:".

There can be no doubt that the poets were fully aware of the nocturnal habits of the beetles, for Tennyson wrote in Claribel that:

"At eve the beetle boometh
Athwart the thicket lone:"

but when day awakened, as pointed out by Shelley in The Boat on the Serchio:

"The beetle forgot to wind his horn,".

Everyone has heard of the sacred scarab beetle of the ancient Egyptians, Scarabaeus sacer. They placed them in the tombs and painted or carved their immage on the sarcophagi

containing the noble dead. Hence the name of the genus and of the family. These beetles belong to a group known as tumble-bugs, because of their habit of forming balls of dung and rolling them to suitable spots and burying them, some for their own sustenance and others, each containing an egg, for the larvae that hatch therefrom. Sometimes two beetles work together in rolling the ball of dung. This was observed and recorded by Robert Browning in his poem Caliban Upon Setebos. Caliban:

> "Sees two black painful beetles roll their ball
> On head and tail as if to save their lives:
> Moves them the stick away they strive to clear."

In his "Introduction to Entomology", Comstock states that from this beetle and its habits "the Egyptians evolved a remarkable symbolism. The ball, which the beetles were supposed to roll from sunrise to sunset, represented the earth; the beetle itself personified the sun, because of the sharp projections on its head, which extend out like rays of light; while the thirty segments of its six tarsi represented the days of the month. All individuals of this species were thought to be males, and a race of males symbolized a race of warriors. This latter superstition was carried over to Rome and the Roman soldiers wore images of the sacred beetle set in rings."

CHAPTER VIII

Order Hymenoptera: The Ants, Bees, Wasps, Ichneumons, etc.

This order includes insects with four membranous wings, of which the second pair are smaller than the first pair and are attached to the latter by a row of chitinous hooks. Their mouthparts are primarily adapted for biting, but also for sucking and lapping liquid food. The females possess an ovipositor which is modified for various purposes: for stinging, as in the bees and wasps; piercing, as in parasitic forms such as the ichneumons, and sawing, as in the destructive sawflies. Their metamorphosis from egg to adult is complete. The order includes the most highly developed of social insects: the ants, the bees and the wasps, the former of which have long been objects of study and popular interest, and have been frequently held up to man as models of industry and order. An example of this is to be found in Pope's Essay on Man (III):

"Thus then to man the voice of nature spoke--
Go, from the creatures thy instructions take:

. . . . .

"Thy arts of building from the bee receive;
Learn of the mole to plough, the worm to weave;

. . . . .

"Learn each small people's genius, policies,
The ants' republic, and the realm of bees;
How those in common all their wealth bestow,
And anarchy without confusion know,
And these forever, though a monarch reign,
Their sep'rate cells and policies maintain,
Mark what unvaried laws preserve each state,
Laws wise as Nature, and as fixed as fate."

Although some forms of hymenoptera, notably the sawflies and the horntails, are destructive to crops and trees, the injury done is doubtless more than counterbalanced by the work of the bees in fertilizing flowers and storing honey, and the activities of large numbers of species of parasites and predators which reduce or control noxious insects, including species in the same order. The order is a large one comprising more than 60,000 described species and many others not yet known to science. In this chapter only those families whose representatives have been featured in the works of the English poets and dramatists are mentioned. These, however, include the most important elements of the order.

Family Formicidae: The Ants.

"What is it all but a trouble of ants in the
gleam of a million million of suns?"
- Vastness: Tennyson.

The ant family is very large both as to species, of which more than 3500 have been described, and numbers, which are countless, and is represented in all parts of the earth, wherever insects can maintain themselves. Because of their widespread distribution and characteristic appearance and habits they are readily recognized, at least in the wingless worker form, by nearly everyone. One striking feature by which ants may be known is the very accentuated demarcation between the head, thorax and abdomen, and the slender pedicel

connecting the latter two regions; another is the geniculate or elbowed antennae. Ants have the most highly developed social system among insects, not even excepting the bees, a system which in many respects is similar to that of man. Consequently they have long been a subject of curiosity and study, and numerous authors have recorded various features of their complex lives. Excellent summaries of the known facts about these fascinating insects accompanied by helpful bibliographies have been published by Imms (30) and Comstock (12).

The poet Milton in Paradise Lost (VII.485) wrote of the first appearance of the ant at the Creation, when "At once came forth whatever creeps the ground, insect or worm":

> "... First crept
> The parsimonious emmet, provident
> Of future, in small room large heart enclosed;
> Pattern of just equality perhaps
> Hereafter, joined in her popular tribes
> Of commonalty:".

Much later in the world's history the ancients recognized the ants as industrious, social, and apparently intelligent creatures, worthy of emulation in some of their habits by humanity. This was demonstrated in the advice proferred by Solomon, Proverbs (VI.6-8), to:

> "Go to the ant, thou sluggard; consider her ways and be wise: Which having no guide, overseer, or ruler, provideth her meat in the summer, and gathereth her food in the harvest."

Each colony of ants is made up of three main castes: the workers, the males or drones and, most important of all, the female or queen. The workers, which are wingless, are undeveloped females and, as their name implies, upon them devolves all the labour of the colony. It is they who feed the queen and tenderly care for and nourish the helpless larvae and watch over the cocoons (often erroneously referred to as "ant eggs"), milk the ant-cows (aphids) of honey-dew, fetch and carry other food, keep clean the galleries and chambers of the colony, and so on. In many species the head and jaws of some of the workers are greatly enlarged and these form the soldier caste. The drones and the queens have wings, but, in the case of the female, these are removed after the nuptial flight, when she either sets up house on her own account or settles down peaceably with the reigning queen in an old established colony. The drones, however, which are rather feeble creatures, largely dependent on the workers for their sustenance, do not return to the colony after fulfilling their function of fertilizing the females, and are soon accounted for by exposure to inclement weather, or devoured by one of their numerous enemies. These nuptial or mating flights occur at the same time from many different nests, so that sometimes large swarms of winged ants suddenly appear. Samuel Purchas recorded one such flight in his Pilgrimage (p.1090): "There are many" (ants), he wrote,

"of which some become winged and fill the air with swarms, which sometimes happens in England. On Bartholomew, 1613, I was in the Island of Foulness on our Essex shore, where were such clouds of these flying pismires, that we could nowhere fly from them, but they filled our clothes; yea the floors of some houses where they fell were in a manner covered with a black carpet of creeping ants: which they say drown themselves about that time of the year in the sea."

From what has been written in the foregoing about the several castes it is clear that Solomon's words apply only to the worker ants, the form with which most people are familiar. Ben Jonson expressed Solomon's appreciation of the diligence and wisdom of the ant in the following verse:

> "Turn on the prudent ant thy heedless eyes,
> Observe her labours, sluggard, and be wise,
> No stern command, no monitory voice
> Prescribes her duties or directs her choice;
> Yet, timely provident, she hastes away
> To snatch the blessings of a plenteous day,
> When fruitful summer loads the teeming plain
> She crops the harvest and she stores the grain."

Before the knowledge of ant behaviour had reached its present level, there was some doubt current as to whether ants really do harvest grain. Actually, the ants of several Myrmicine genera feed on seeds, and harvest and store them in special chambers after biting off the radicle to prevent germination. The harvesting ants are mostly confined to warm arid regions where insect food is scarce. As Robert Browning has expressed it:

"... the hoard
Of the sagacious ant shows garnered grain
Ever most abundant when fields afford
Least pasture."

The food habits of ants are extremely varied. Some of the more primitive forms are predacious and carnivorous, whereas species of the higher groups feed upon plant secretions and exudations such as nectar and sap, the honey-dew from aphids and certain other insects, also fruit, fungi, etc. Certain leaf-cutting ants in the warmer regions of America cultivate fungi for food purposes in special underground chambers called fungus-gardens. The Selenites, the imaginary creatures inhabiting the moon in H.G. Wells well-known story "The First Men in the Moon", were ant-like in appearance and habits, and cultivated subterranean fungus-gardens, to ensure themselves of a continued food supply when the intense cold during the long lunar nights forced them to live underground. Perhaps Wells borrowed his ideas in this story from the ants.

In northern latitudes ants are dormant during the cold winter months. Shakespeare revealed knowledge of this in King Lear (II.4), when he caused the Fool to say to the Earl of Kent:

"We'll set thee to school to an ant, to
teach thee there's no labouring i' the winter."

There are only two other allusions to ants in Shakespeare's works. One of these is in Part I Henry IV (III.1). When Mortimer chided Hotspur for crossing his father-in-law

Glendower, Hotspur explained that sometimes Glendower angered him:

> "With telling me of the moldwarp and the ant, of the dreamer Merlin... of a dragon... a clip-wing'd griffin... and such a deal of skimble - skamble stuff as put me from my faith."

The other reference is in the same play (I.3.240) and appears when the Earl of Northumberland called Hotspur "a wasp-tongued and impatient fool" for not controlling his speech. This also provoked an explanation from Hotspur:

> "Why, look you, I am whipp'd and scourged with rods, nettled, and stung with pismires, when I hear of this vile politician, Bolingbroke."

Needless to say, perhaps, the word "pismire" is an obsolete term for ant and, according to the Oxford Dictionary, owes its origin to the smell of an ant hill. Chaucer used it in The Sompnoure's Tale in the lines:

> "He is as angry as a pissemyre,
> Though that he have al that he can desire,".

Although the ants in a colony live in harmony among themselves, they are generally hostile to other living creatures except certain species of insects, which they tolerate or encourage in their nests as "guests". Any other intruders, including man, are angrily resented. Chaucer had probably observed disturbed ant colonies in an uproar and drew his apt simile therefrom. The true ant guests are mostly beetles, which repay their hosts for their board and lodging by means of exudations and secretions which are very attractive to the ants.

Among species of stinging ants, the power to inflict the sting is confined to the females, including the workers, this operation being performed by the ovipositor. The poison injected contains formic acid. This acid many years ago was considered of value in curing nervous complaints, and in some cases was applied by inducing ants to sting the patient. Before formic acid was made synthetically, tincture of ants was prepared for medicinal purposes by macerating ants in alcohol. Ants' "eggs" or more correctly ants' pupae were also used in medicine. An allusion to

"purging comfits and ants' eggs"

was included by Butler in his Hudibras, written in the seventeenth century.

While on the subject of stinging ants, reference might be made to the savage carnivorous driver or legionary ants of the tropics. These terrible ants, which belong to the genera Dorylus and Eciton, are blind and make their sorties at night, or during the day when the sun is not shining. They march army-like in columns, destroying all living creatures in their path. They bridge streams with the bodies of their fellows, and will cross through an encircling fire by smothering a pathway through it in a similar manner. Burr (9, p.50) says that even the elephant looks upon the African driver ants with mortal terror, because they may enter his sensitive trunk and drive him into a frenzy. Edmund Spenser seems to have had such

an occasion in mind when he described, in Visions of the World's Vanity (VIII), how that the elephant, bedecked and bearing a gilded tower on his back was all puffed up with pride:

"Till that a little Ant, a silly worme,
Into his nostrils creeping, so him pained,
That, casting downe his towres, he did deforme
Both borrowed pride, and native beauty stained."

Aesop was familiar with the ant's "bite", or rather sting. This is shown in his fable of "The Dove and the Ant", the moral of which was, that one good turn deserves another. The ant was drinking beside a stream and fell in, and was in imminent danger of drowning when a dove, taking pity on her plight, dropped a twig into the water. The ant crawled upon this and was carried to the bank and escaped. Later, a hunter was about to shoot the dove when the ant crept up the back of his leg and bit him so hard that his aim was spoiled, and the dove was unharmed.

The effect of the ant's "bite" was used by Tennyson to denote extreme annoyance. This was in his poem Pelleas and Ettarre, wherein Queen Guinevere was so irritated by a remark of the Lady Ettarre, that she glanced down upon her,

"as one whose foot is bitten by an ant,"

and "turned and went her way".

Besides possessing virtues which mankind might emulate with profit, the ants also have some serious vices which unfortunately are not unknown to humanity. One of the worst of these is slave-making, which is practiced by four

genera of ants that live only in the northern hemisphere. A typical species common to Europe and America is the blood-red robber or slave ant, Formica sanguinea, which raids the nests of related species for their worker larvae and pupae, some of which are eaten and the others reared to become slaves in the nest of their captors. Another European species of ants called amazons, Polygus rufescens, has become absolutely dependent on such slaves for its continued existence. This fact has a moral for humanity: slavery is degrading and demoralizing and contains within it the seeds of disintegration and ultimate destruction, both for the individual and the society that practices it. Self-help is good for all. This thought was expressed nearly two hundred years ago by James Thomson, in The Castle of Indolence (I.3), when he urged mortal man to not complain:

> "That like an emmet thou must ever moil,...
> Withouten that would come a heavier bale,
> Loose life, unruly passions, and diseases pale."

Some species of ants such as the carpenter ant are destructive to property, but most of them are more of a nuisance than an economic pest. They invade dwellings and get into foodstuffs and call forth cries of horror from the housewife, or construct mounds in the lawn to the dismay of the gardener, and in sundry other ways interfere with man's comfort and pleasure. They may even disturb the path of true love, as humorously suggested by Thomas Hood in Love Lane, wherein the lover says he was making good progress in proposing

to his sweetheart:

"But when I ventured to abide
Her father and her mother's grants--
Sudden she started up and cried,
'O dear, I am all over ants!'"

Michael Drayton also mentioned the ant in a poem of lighter vein. In Nymphidia (242) is a description of how King Oberon in pursuit of Pigwiggen, whom he thought had run off with Queen Mab, had encounters with a wasp, a glow-worm and a hive of bees and then:

"A new adventure him betides:
He met an ant which he bestrides,
And post thereon away he rides,"

until he is unseated, runs smack into a mole-hill, and finally falls into a lake which cools his fury.

Before bringing this section on ants to a close it would seem worth while including the following amusing poem about the ant which carries an excellent moral. It was written in the eighteenth century by the brilliant Scottish poet, Allan Ramsay:

"A pensy Ant, right trig and clean,
Came ae day whidding o'er the green,
Where, to advance her pride, she saw
A Caterpillar moving slaw.
'Good ev'n t' ye, Mistress Ant,' said he;
'How's a' at hame? I'm blyth to s' ye.'
The saucy Ant view'd him wi' scorn,
Nor wad civilities return;
But gecking up her head, quoth she
'Poor animal! I pity thee;
Wha scarce can claim to be a creature,
But some experiment o' Nature,
Whase silly shape displeased her eye,
And thus unfinish'd was flung bye.
For me, I'm made wi' better grace,
Wi' active limbs and lively face;

"And cleverly can move wi' ease
Frae place to place where'er I please;
Can foot a minuet or jig,
And snoov't like ony whirly-gig;
Which gars my jo aft grip my hand,
Till his heart pitty-pattys, and--
But laigh my qualities I bring,
To stand up clashing wi' a thing,
A creeping thing the like o' thee,
Not worthy o' a farewell t' ye.'
The airy Ant syne turned awa,
And left him wi' a proud gaffa.
The Caterpillar was struck dumb,
And never answered her a mum:
The humble reptile fand some pain,
Thus to be banter'd wi' disdain.
But tent neist time the Ant came by,
The worm was grown a Butterfly;
Transparent were his wings and fair,
Which bare him flight'ring through the air.
Upon a flowere he stapt his flight,
And thinking on his former slight,
Thus to the Ant himself addrest:
'Pray, Madam, will ye please to rest?
And notice what I now advise:
Inferiors ne'er too much despise,
For fortune may gie sic a turn,
To raise aboon ye what ye scorn:
For instance, now I spread my wing
In air, while you're a creeping thing.'"

Family Apidae: The Honey Bee.

"Thise flyes that men clepeth bees".
- Parson's Tale: Chaucer.

The honey bee, or Apis mellifica L., to give it its scientific name and avoid confusion with other species, shares with the silkworm moth the distinction of being one of the greatest insect benefactors of the human race. Man was probably familiar with the bee and its honey while still a nomadic hunter. Certain it is that the bee developed a complex

social life long before mankind lived together in civilized communities. Less than two-hundred years have elapsed since cane sugar became available to the masses. For many centuries before that happy development man was largely dependent on the honey bee for his sweets. Little wonder then that he was greatly concerned for the bee's welfare, and provided it with homes to hive in under his protection, in place of the, perhaps hard-to-find hollow trees, or cavities in rocks which were its natural shelter in the wild state. Poets, philosophers, naturalists, and the average man have all evinced a keen interest in the honey bee and its works, and have recorded their emotions, thoughts, and findings in numerous parchments and publications over the centuries, so that now it is perhaps the best known of all the insects. For instance, Phillips (45) in his book on beekeeping published in 1918, stated that a bibliography on beekeeping literature maintained by the Bureau of Entomology at Washington contained about 20,000 titles. The information handed down was not always correct, especially from the ancients, the facts sometimes being mixed with strange fictions or superstitions, which persisted for many hundreds of years. An example is the story of the bees written by the Roman poet Virgil nearly two thousand years ago. This is in beautiful language and contains some accurate observations but also, unfortunately, many erroneous beliefs.

Samson appears to have originated the old superstition that bees sometimes hive in the carcasses of dead

animals. It is recorded in Judges (XIV.8-10) that when returning to Timnath for the Philistine woman of his choice, he "turned aside to see the carcase of the lion" (which he had slain on his previous visit): "and, behold, there was a swarm of bees and honey in the carcase of the lion. And he took thereof in his hands, and went on eating, and came to his father and mother, and he gave them, and they did eat: but he told not them that he had taken the honey out of the carcase of a lion." On this basis he set the Philistines a riddle which they only solved with the connivance of his bride and with dire consequences to her and to themselves. The riddle was: "Out of the eater came forth meat, and out of the strong came forth sweetness." And the answer the Philistines gave was "What is sweeter than honey? and what is stronger than a lion?"

It has been suggested that what Samson saw were drone flies (Syrphidae), which are often mistaken for bees and may be seen about decaying matter. This of course would not explain the presence of honey. Catlow (10, p.288) says that: "it must be remembered that some months had elapsed before Samson's second visit to the scene of his exploit, -- ample time, in that country, with the assistance of birds and beasts of prey, to reduce the carcase of the lion to a perfectly clean skeleton, in which state it would form an appropriate habitation for these little insects."

In his poem The Bees and the Flies, Rudyard Kipling

describes the experience of one poor farmer who believed the legend sufficiently to put it to the test.

"A farmer of the Augustan Age
Perused in Virgil's golden page,
The story of the secret won
From Proteus by Cyrene's son--
How the dank sea-god showed the swain
Means to restore his hives again.
More briefly, how a slaughtered bull
Breeds honey by the bellyful.

"The egregious rustic put to death
A bull by stopping of its breath,
Disposed the carcass in a shed
With fragrant herbs and branches spread,
And, having thus performed the charm,
Sat down to wait the promised swarm.

"Nor waited long. The God of Day
Impartial, quickening with his ray
Evil and good alike, beheld
The carcass--and the carcass swelled.
Big with new birth the belly heaves
Beneath its screen of scented leaves.
Past any doubt, the bull conceives!

"The farmer bids men bring more hives
To house the profit that arrives;
Prepares on pan, and key and kettle,
Sweet music that shall make 'em settle;
But when to crown the work he goes,
Gods! what a stink salutes his nose!

"Where are the honest toilers? Where
The gravid mistress of their care?
A busy scene, indeed, he sees,
But not a sign or sound of bees.
Worms of the riper grave unhid
By any kindly coffin lid,
Obscene and shameless to the light,
Seethe in insatiate appetite,
Through putrid offal, while above
The hissing blow-fly seeks his love,
Whose offspring, supping where they supt,
Consume corruption twice corrupt."

Shakespeare, too, was aware of this ancient belief and apparently had some doubts as to its accuracy, for in

2 Henry IV (IV.4), he put into the mouth of the King, who feared that his son would not forsake his bad companions, the words:

> "'Tis seldom when the bee doth leave her comb
> In the dead carrion."

There are many references to honey as a food in the Bible. A familiar one is in I Samuel (XIV.24-7), which occurred during Saul's battle with the Philistines:

> "Saul had adjured the people, saying, 'Cursed be the man that eateth any food until evening, that I may be avenged on mine enemies'. So none of the people tasted any food. And all they of the land came to a wood and there was honey upon the ground. And when the people were come into the wood, behold, the honey dropped; but no man put his hand to his mouth; for the people feared the oath. But Jonathan heard not when his father charged the people with the oath; wherefore he put forth the end of the rod that was in his hand, and dipped it in an honeycomb, and put his hand to his mouth; and his eyes were enlightened."

Another reference is to be found in Matthew (III.4) concerning "John the Baptist, preaching in the wilderness of Judaea.... And the same John had his raiment of camel's hair, and a leathern girdle about his loins; and his meat was locusts and wild honey." The locusts of course were grasshoppers.

There are several varieties of honey bees inhabiting different regions, and one of these, the Egyptian, which occurs in North Africa and Arabia is said to sting furiously and be easily aroused. It may have been this variety that Moses referred to in Deuteronomy (I.44) when he pointed out to the Israelites that they ignored the Lord's warning given through

him, and went up against their enemies in the hills:

> "And the Amorites, which dwelt in that mountain,
> came out against you, and chased you, as bees do,".

The psalmist in Psalm 118 also sang of his enemies that "They compassed me about like bees;".

The sting of the bee is usually inflicted by the workers in defence of the hive. The drone is stingless, and the queen rarely uses her sting except to dispatch rival queens. There seems to have been a wholesome appreciation of the stinging powers of the bee among the poets. In Shakespeare's 2 Henry VI (III.2), when the Earl of Warwick learns that Humphrey, Duke of Gloucester, has been murdered, he says to the King:

> "The commons, like an angry hive of bees,
> That want their leader, scatter up and down,
> And care not who they sting in his revenge."

And in Titus Andronicus (V.1):

> "Be bold in us: we'll follow where thou lead'st
> Like stinging bees in hottest summer's day
> Led by their master to the flower'd fields."

Shakespeare was wrong, of course, in indicating that the bees have a male leader. Actually, the workers carry out the defence of the hive and visit the fields entirely on their own, but more of that anon. Edmund Spenser recorded in Epigrams (IV.3) that "a gentle Bee... about him flew", and later, that "the Bee him stung", which rather discredited its supposed gentleness.

The early seventeenth century poet Sir John Suckling, in A Ballad Upon a Wedding, noted of the bride that:

"Her lips were red, and one was thin;
Compared with that was next her chin,--
Some bee had stung it newly;"

thus imparting a very homely touch to the scene. Robert Burns observed the uproar that occurs when a bees' hive is disturbed and mentioned it in Tam O'Shanter:

"As bees bizz out wi' angry fyke,
When plundering herds assail their Eyke;".

The bee's sting is not to be treated lightly for it is an excellent weapon for defence. It consists of the modified ovipositor and is barbed towards the tip, so that it is frequently left in the wound, and may penetrate deeper if not promptly removed. Poison secreted by certain glands is injected into the wound from a poison sac attached to the base of the sting. The poor bee usually only stings in defence of the colony, for if the sting is torn away from her she dies shortly afterwards. This was alluded to by Tennyson, in the Ancient Sage:

"Nor thou be rageful, like a handled bee,
And lose thy life by usage of thy sting;".

The highly developed social order of the bees is a continual source of wonder to man, and has been described by many writers. One of the most beautiful poetical descriptions, if not the most accurate, was written by Shakespeare in the play Henry V (I.2). The words were spoken by the Archbishop of Canterbury:

"... so work the honey bees;
Creatures that by a rule in nature teach
The art of order to a people kingdom.
They have a king, and officers of sorts;
Where some, like magistrates, correct at home,
Others, like merchants, venture trade abroad,
Others, like soldiers, armed in their stings,
Make boot upon the summer's velvet buds;
Which pillage they with merry march bring home
To the tent-royal of their emperor;
Who, busied in his majesty, surveys
The singing masons building roofs of gold;
The civil citizens kneading up the honey;
The poor mechanic porters crowding in
Their heavy burdens at his narrow gate;
The sad-eyed justice, with his surly hum,
Delivering o'er to executors pale
The lazy yawning drone."

There is, of course, no king or emperor in the bee colony, but a queen, who is the largest individual in the hive. Her function is not to rule over the colony, but to lay eggs. Usually there is only one queen to each colony, but her egg-laying capacity is prodigious, and may reach 2000-3000 per day at the height of the season. The old queen may live for several years, but she is quickly superseded by a young queen reared by the workers when she fails in egg-laying.

The "lazy yawning drone" is the male bee and his only useful function is mating with a young virgin queen, after which he dies. The drones do no work and consume considerable stores. Their very name connotes idleness and uselessness. Shylock, in the Merchant of Venice (II.5) said of his servant Launcelot that he was unprofitable, a large eater, and lazy, and added:

"Drones hive not with me;".

During the summer, the drones in a colony may become fairly

numerous, but when the honey flow slows down and stops the workers eliminate them. As the King in All's Well That Ends Well (I.2) put it:

"Since I nor wax nor honey can bring home,
I quickly were dissolved from my hive,
To give some labourers room."

The bee colony is made up of three castes of bees, the queen and the drones already discussed, and the workers, which comprise the bulk of the members. The merchants, soldiers masons, civil citizens and porters mentioned in Shakespeare's description all belong to this caste. They do all the work: feed and care for the queen and the young, construct the comb, guard the hive and keep it clean and properly ventilated, gather nectar and pollen, and manufacture the wax and honey, and do anything else that has to be done. They have long been held up as shining examples of tireless industry, and the expression "busy as a bee" is widely used to denote excessive activity. John Lyly, in Euphues and his England, referred to "a comely olde man as busie as a bee"; and Isaac Watts in Divine Songs, Song No.20 - Against Idleness, included that well-known verse:

"How doth the busy little bee
Improve each shining hour,
And gather honey all the day
From every opening flower!"

Well might William Blake write that, "the busy bee has no time for sorrow". The bees that emerge during the summer when nectar is plentiful work continuously from sunrise to sunset. In fact, they literally work themselves to death, their average life

under such conditions being only six or seven weeks. Of course, those that emerge in the autumn live longer, which is fortunate, as they are required to carry the colony through the winter and perform the necessary labours of the following spring. John of Salisbury, Thomas Becket's friend in Tennyson's play, Becket (V.2.218), evidently had a poor opinion of women as housewives, if one may judge from his remark to Becket:

"So rare the household honeymaking bee,
Man's help! but we, we have the Blessed Virgin
For worship, and our Mother Church for bride;".

Up to less than a hundred years ago the beehive commonly used in England was a simple dome-shaped structure called a "skep" hive in which all the work of making the combs was left to the bees. The modern beehive is box-shaped and made of wood, and fitted with movable trays containing frames of wax on which the bees can build their cells, thus saving them labour and increasing the honey production. The following poetical allusions are to the old picturesque skep hive. In Michael Drayton's Nymphidia, written more than 300 years ago, fairy King Oberon in his pursuit of Pigwiggen attacked a glow-worm in mistake for a devil and:

"From thence he ran into a hive,
Amongst the bees he letteth drive,
And down their combs begins to rive,
All likely to have spoiled:
Which with their wax his face besmear'd,
And with their honey daub'd his beard;
It would have made a man afear'd,
To see how he was moiled."

Fortunately it was night time or King Oberon would have been

badly stung, unless his fairy royal state protected him. Anyhow, he must have been in a nasty, sticky mess.

Usually, especially in England, beehives are situated amid scenes of tranquil rustic beauty. The vicar of the church among the mountains, in Wordsworth's poem The Excursion (6.1169), kept bees in such a place, and told his visitor that:

"... my leisure draws
A not infrequent pastime from the hum
Of bees around their range of sheltered hives
Busy in that enclosure;".

In his poem in praise of country life, The Wish, Samuel Rogers, who himself lived in a splendid mansion, wrote:

"Mine be a cot beside a rill;
A beehive's hum shall soothe my ear;
A willowy brook that turns a mill,
With many a fall, shall linger near."

The continual hum is made by the bees in their constant journeyings to and from the hive, collecting and carrying spoils from the flowers. Or, as Wordsworth expressed it in The Soaring:

"The roving bee proclaims aloud
Her flight by vocal wings."

This phase of the bee's activities has naturally been most frequently observed by the poets and, as it appeals strongly to their aesthetic sense, has been mentioned in numerous poems. There is the well-known musical couplet sung by Ariel in The Tempest (V.1):

"Where the bee sucks, there suck I;
In a cowslip's bell I lie:",

and this piece of descriptive verse from James Thomson's,

The Seasons - Spring:

"Here their delicious task the fervent bees,
In swarming millions, tend: around, athwart,
Through the soft air, the busy nations fly,
Cling to the bud, and, with inserted tube,
Suck its pure essence, its ethereal soul;
And oft, with bolder wing, they soaring dare
The purple heath, or where the wild thyme grows,
And yellow load them with the luscious spoil."

Robert Burns, who included more than a dozen allusions to bees in his songs and poems, sang through his Willy to Philly:

"The bee that thro' the sunny hour
Sips nectar in the opening flower,
Compar'd wi' my delight is poor,
Upon the lips o' Philly."

Another musical gem from Burns is this:

"Amang the trees, where humming bees
A buds and flowers were hinging, O",

or this from Tam O'Shanter:

"As bees flee hame wi' lades o' treasure
The minutes wing'd their way wi' pleasure:".

A remarkable fact about the bees is the apparent organization of the workers to ensure a proper division of labour, and to prevent overlapping or duplication of activities. There seems to be an allocation of the available territory among the workers. Furthermore, they usually collect nectar from only one species of plant during any one trip. This is of primary importance in the fertilization of the flowers, the pollen being carried from blossom to blossom on the hairy bodies of the insects. In the following, from The Church. Providence, George Herbert wrote that:

"Bees work for man, and yet they never bruise
Their Master's flower, but leave it having done,
As fair as ever and as fit to use;
So both the flower doth stay and honey run."

This is a nice thought, but not really quite accurate, for flowers that have been fertilized by the bee's visit soon die, their function of attracting the insect to ensure pollination having been completed. This is, in fact, a problem with which commercial flower growers have to contend.

In visiting the flowers more pollen adheres to the bee's hairy body than is required for fertilization purposes, and the surplus is brushed by the bee from its body and legs, and packed into the pollen basket formed by the long hairs on the hind legs. This is carried to the hive where that not required for immediate consumption is stored in comb cells, topped with a little honey and capped with wax. It was probably the pollen that John Gay meant by "golden treasures", in the following from Rural Sports (Canto I.1.32):

"The careful insect 'midst his works I view,
Now from the flowers exhaust the fragrant dew,
With golden treasures load his little thighs,
And steer his distant journey through the skies."

In these lines Gay repeats a common error by referring to the worker bee as a male. Actually it is a female with undeveloped sexual organs.

Honey is made from nectar taken into the bee's crop, from which it is regurgitated and stored in cells in the honey comb. This was not known to earlier writers some of whom

mistook the pollen baskets for the "honey-bags", and others for wax carriers. For instance, Milton, in Il Penseroso wrote:

"Hide me from day's garish eye,
While the bee with honey'd thigh,
That at her flowery work doth sing,";

and Robert Herrick contributed this pretty piece in The Present:

"Fly to my Mistresse, pretty pilfering Bee,
And say, thou bring'st this Honey-bag from me:
When on her lip, thou hast thy sweet dew plac't;
Mark, if her tongue, but sloly, steal a taste.
If so, we live; if not, with mourneful humme,
Tole forth my death; next, to my buryall come."

Patrick Cary also alluded to the "bag" of the bee in the following lines from Whilst I Beheld the Neck of the Dove, which point out that we have much to be grateful for.

"I took the honey from the bee,
On th' bag these words were seen.
'More sweet than this
Perchance nought is,
Yet gall it might have been':".

Sometimes during the summer the bees load themselves so heavily with nectar and pollen that it is only with difficulty that they can fly back to the hive, especially when the collecting is done some distance away from the colony. Robert Burns probably had this in mind when he wrote in Bonnie Jean:

"O blaw ye westlin winds, blaw saft
Amang the leafy trees;
Wi balmy gale, frae hill and dale
Bring hame the laden bees;".

The death of the worker bee during the active season usually

occurs while the little creature is unsuccessfully striving to return to the hive from its last collecting trip.

The remarkable manner in which the bees locate the flowers, and also find their way back to the hive from considerable distances without becoming lost, has long been a subject of interest and controversy. At one time it was thought that the flowers were selected by their perfume, a popular idea apparently shared by Christopher Marlowe, as indicated in these lines from Hero and Leander, which refer to Venus:

> "Many would praise the sweet smell as she past,
> When t'was the odour which her breath forth-cast;
> And there, for honey, bees have sought in vain,
> And, beat from thence, have lighted there again."

Two centuries later, Samuel Rogers expressed a similar belief, namely, that the bees find their way back to the hive by recalling the odours of the various flowers they had visited on the outward journey. Here is the verse:

> "Hark! the bee winds her small but mellow horn,
> Blithe to salute the sunny smile of morn.
> O'er thymy downs she bends her busy course,
> And many a stream allures her to its source.
> 'Tis noon, 'tis night. That eye so finely wrought,
> Beyond the search of sense, the soar of thought,
> Now vainly asks the scenes she left behind;
> Its orb so full, its vision so confined!
> Who guides the patient pilgrim to her cell?
> Who bids her soul with conscious triumph swell?
> With conscious truth retrace the mazy clue
> Of varied scents that charm'd her as she flew?
> Hail, MEMORY, hail! thy universal reign
> Guards the least link of Being's glorious chain."

However, modern beekeepers understand that it is not the sense

of smell, but of sight, which guides the bees home. The insects memorize the location and position of the hive and of various objects which they pass on the outward flight, and may become lost if the hive is moved only a short distance away during their absence.

Inside the beehive is the comb, composed of hexagonal cells made of wax and arranged in two vertical layers back to back. These cells are used for rearing the brood and storing pollen and honey. The cells are made by the young worker bees which were referred to by Edmund Spenser in Shepherd's Calendar (D.67):

> "I was wont to seeke the honie bee,
> Working her formall rowmes in wexen frames,".

Shakespeare had in mind the enormous number of cells which comprise the comb in Prospero's reply to Caliban's imprecations, in The Tempest (I.2):

> "Thou shalt be pinch'd
> As thick as honeycombs, each pinch more stinging
> Than bees that made them."

When it is realized that a colony of bees may contain from 10,000 to 80,000 individuals all reared from waxen cells it will be seen that this was no light threat.

The wax of which the comb is made is secreted by the worker bees and is not collected from flowers and brought to the hive on the "thighs" of the insects, as was believed by many people and mentioned in the following lines by Parnell, who also thought of the bees in the masculine gender:

"Thus in a thousand wax-erected forts
A loitering race the painful bee supports;
From sun to sun, from bank to bank he flies,
With honey loads his bag, with wax his thighs."

When wax is required, the young workers gorge themselves on honey and hang suspended from the roof of the hive, curtain-like, one clinging to the other. Presently the wax exudes from hypodermal glands between the segments on the underside of the abdomen and hardens in thin plates. The bee transfers these plates to the mandibles by transfixing them on certain spines on the hind legs, and they are then kneaded and used in constructing the comb. Apparently, in Elizabethan times, the wax was used for sealing legal documents and love letters, for Shakespeare alluded to its use for these purposes. In 2 King Henry VI (IV.2), Jake Cade, the rebel, replying to Dick the Butcher's suggestion that they first kill all the lawyers, says:

"Nay, that I mean to do. Is not this a lamentable thing, that of the skin of an innocent lamb should be made parchment? That parchment, being scribbled o'er, should undo a man? Some say the bee stings: but I say, 'tis the bee's wax; for I did but seal once to a thing, and I was never mine own man since."

Also in Cymbeline (III.2), when Imogen received a letter from her lord Leonatus, she broke the seal with these words:

"Good wax, thy leave. Blest be
You bees that make these locks of council!"

Besides wax, the bees use a material known as propolis in their construction work. This is a resinous material

collected from the buds and other parts of various trees, especially poplars, and is used for filling up crevices and reinforcing the comb. It is carried to the hive in the pollen baskets. According to Phillips (45, p.117), "they (the workers) clean the hive, and in case they are unable to remove the debris, they may cover it with propolis. Lizards, small snakes and other intruders to the hive, which are too large for the workers to remove, are sometimes found as 'mummies' on the hive bottom, sealed in propolis." Tennyson alluded to this practice in Queen Mary (III.3):

> "But they say that bees,
> If any creeping life invade their hive,
> Too gross to be thrust out, will build him round
> And bind him in from harming of their combs."

In early summer, as the bee colony increases in strength, royal cells are made, which are ovoid in form and considerably larger than the six-sided worker cells. In these the queen larvae are reared on "royal jelly", which may be glandular in origin and is secreted from the workers' mouths, instead of honey and bee-bread (pollen), which is the principal diet of the larvae of the drones and workers. The virgin queens are reared in small numbers to emerge at short intervals. When a young queen is ready to emerge, the old queen departs from the hive with a proportion of the workers to establish a colony elsewhere. Before leaving the hive the bees gorge themselves with honey, so that they will not be hungry for a few days, and in this well-fed condition are usually too torpid to be

aggressive or to sting. This whole process is called swarming. Milton wrote in Paradise Lost (VII.489) that, at the creation, after the ant:

> "... swarming next appeared
> The female bee, that feeds her husband drone
> Deliciously, and builds her waxen cells
> With honey stored:"

a description that fits the worker bee rather than the queen, except for the reference to the "husband drone".

Chaucer alluded several times to swarms of bees. In the Sompnoure's Prologe, for instance, the angel ordered Satan to show a visiting frere where he kept the freres in hell, as none were in sight:

> "'Hold up thy tayl, thou Sathanas', quod he,
> 'Wher is the nest of freres in this place'.
> And er than half a forlong way of space,
> Right so as bees swarmen out of an hyve,
> Out of the develes ers thay gonne dryve,
> Twenty thousand freres on a route,
> And throughout helle swarmed al aboute,".

Drumming on an empty box placed over a beehive may cause the bees to gorge with honey and swarm into the box. It used to be thought that bees swarming in the open could be induced to settle by beating tin cans and in other ways making a din, but there is no truth in this belief. Disturbance of bees by noise was referred to by Chaucer in the Nun's Priest's Tale, when the fox was being pursued:

> "The dokes (ducks) criden as men wold hem quelle;
> The gees for fere flowen over the trees;
> Out of the hyve came the swarm of bees;
> So hidous was the noyse, a benedicite!"

Of course, the beekeeper has to take prompt action when any of his colonies swarm, as otherwise they may be lost, and doubtless there is much

"... hurry and alarm
When the beehive casts its swarm;"

as suggested by Keats in the poem Fancy.

After the old queen has departed with her swarm of workers, the virgin queen goes off on a marriage flight, and returns to carry on her function of repopulating the hive. Sometimes two or more swarms are given off from the colony during the season. This depletes the colony and causes loss to the honey crop, and sometimes loss of swarms. This problem of the beekeeper is stated in the following old English nursery rhyme:

"A swarm of bees in May
Is worth a load of hay;
A swarm of bees in June
Is worth a silver spoon;
A swarm of bees in July
Is not worth a fly."

When the new virgin queen emerges, and prior to her mating flight, she usually visits the royal cells and stings to death the other young queens. If, instead of doing this, she flies off with another swarm, the process of swarming may be repeated several times, with the result that the successive swarms are too small and weak to be of value, and the parent colony loses the ability to gather surplus honey.

The somnolent sound made by swarming bees was mentioned by several poets. In Chaucer's Squire's Tale are

the descriptive words:

"They murmureden as dooth a swarm of bees;"

and in Spenser's Faerie Queene (I.1) the sprite who went to the castle of Morpheus found the latter hard to wake:

"A trickling streame from high rock tumbling downe,
And ever-drizling raine upon the loft,
Mixt with a murmuring winde, much like the sowne
Of swarming bees, did cast him in a swowne."

Tennyson, too, in The Princess (VII.222), wrote of the:

"Myriads of rivulets hurrying thro' the lawn,
The moan of doves in immemorial elms,
And murmuring of innumerable bees."

Whoever has reclined in relaxed contentment in flower-strewn meadow or woodland on a warm summer's day and drowsily listened to the bees gathering nectar and pollen will appreciate Wordsworth's beautiful lines from the Vernal Ode (IV):

"To lie and listen -- til o'er-drowsèd sense
Sinks, hardly conscious of the influence --
To the soft murmur of the vagrant Bee.
--A slender sound! yet hoary time
Doth to the Soul exalt it with the chime
Of all his years;-- a company
Of ages coming, ages gone;

. . . . .

"... that faint utterance, which tells
Of treasure sucked from buds and bells,
For the pure keeping of those waxen cells;".

John Keats, on the other hand, in his Epistle to George Keats, thought:

"That the still murmur of the honey bee
Would never teach a rural song to me:",

and Robert Browning, in Up at a Villa - Down in the City, expressed the reaction of some to the song of the bee in the words:

"And the bees keep their tiresome whine round
the resinous firs on the hill."

Nowadays, beekeepers remove the bees' surplus stores of mature honey without causing any injury to the bees. In times past, however, it was a common practice to kill the bees in order to obtain the honey. This was alluded to in Shakespeare's 2 Henry IV (IV.5); when the dying king found his crown missing from his pillow and learned that the Prince of Wales had taken it, he suspected a sinister motive, and exclaimed in grief:

"How quickly nature falls into revolt
When gold becomes her object!...
When, like the bee, culling from every flower
The virtuous sweets,
Our thighs pack'd with wax, our mouths with honey,
We bring it to the hive; and, like the bees,
Are murder'd for our pains."

There is a description of the wanton killing of the bees to get their honey in Thomas Hardy's Under the Greenwood Tree:

"'Here I be, Enoch', said a voice; and the procession advancing further, the lantern's rays illuminated the figure of Geoffrey awaiting their arrival beside a row of bee-hives in front of the path. Taking the spade from Enoch he proceeded to dig two holes in the earth before the hives.... The preliminaries of execution were arranged, the matches (made of lath and brown paper dipped in brimstone) fixed, the stakes kindled, the two hives placed over the two holes, and the earth stopped round the edges.... 'Those holes will be the grave of thousands!' said Fancy. 'I think 'tis rather a cruel thing to do.'"

Shakespeare also referred to the smoking out of the bees in 1 Henry VI (I.5), in the words used by Lord Talbot in describing the effect of Joan of Arc (La Pucelle) on the

English soldiers:

"A witch, by fear, not force, like Hannibal,
Drives back our troops and conquers as she lists:
So bees with smoke and doves with noisome stench
Are from their hives and houses driven away."

Another allusion by Shakespeare to robbing the bees, is to be found in Julius Caesar (V.1), in the reply which Cassius and Brutus made to Antony's accusation that: "In your bad strokes Brutus, you give good words: witness the hole you made in Caesar's heart, crying 'Long live! hail, Caesar!'

Cas. "Antony, the posture of your blows are yet
unknown; but for your words, they rob the
Hybla bees, and leave them honey-less."
Ant. "Not sting-less too."
Bru. "O! yes, and soundless too;
For you have stolen their buzzing, Antony,
And very wisely threat before you sting."

The honey that is taken from the beeshive is the nectar disgorged from the crop or honey stomach of the bees into the cells of the honeycomb where it is "ripened". In this process the water content is reduced from more than sixty per cent to about twenty per cent and the cane sugar (sucrose) content is inverted into glucose and laevulose. The wholesome food value and attractive flavour of honey are too well known to need emphasis. However, if one eats too much he may agree with Friar Laurence in Shakespeare's Romeo and Juliet (II.6) that:

"... the sweetest honey
Is loathsome in his own deliciousness
And in the taste confounds the appetite:".

In the Faerie Queene (IV), Spenser likened love to a mixture

of gall and honey, in which the gall greatly predominates, thus:

> "True be it said whatever man it said
> That love with gall and honey doth abound;
> But if the one be with the other weighed,
> For every dram of honey therein found
> A pound of gall doth over it redound."

Wordsworth, in The Prelude (XI.443), repeats the story told by Theocritus, the pastoral poet of Syracuse, how "Divine Comates" imprisoned in a chest was fed with honey.

> "I hear thee tell how bees with honey fed
> Divine Comates, by his impious lord
> Within a chest imprisoned; how they came
> Laden from blooming grove or flowery field,
> And fed him there, alive, month after month,
> Because the goatherd, blessed man! had lips
> Wet with the Muses' nectar."

To have done this the bees would have had to take the honey from the honeycomb, and not direct from the flowers which, as already mentioned, would only yield dilute nectar.

After the sources of nectar have gone, and the surplus stores of honey have been removed by the beekeeper, the bees begin to prepare themselves for survival through the cold weather. They drive out the drones and cease to rear any more brood, and cluster together in the comb, where they are separated from each other only by the wax walls of the comb cells. By feeding on the stored food they are able to generate sufficient heat to maintain a satisfactory thermal environment regardless of external fluctuations of temperature, a feat in which the honeybee is unique among insects. Early the following season brood-rearing is recommenced, and on warm

days the workers leave the hive to visit the earliest spring flowers. This naturally has been observed by the poets who associate the first appearance of the bees with the arrival of spring. For instance, here is a portion of the Earl of Surrey's Description of Spring, Wherein Everything Renews, Save Only the Lover; which was written about four hundred years ago:

"The buck in brake his winter coat he flings;
The fishes flete with new repaired scale;
The adder all her slough away she slings;
The swift swallow pursueth the flies smale;
The busy bee her honey now she mings;
Winter is worn that was the flowers' bale."

Much later, in Cap and Bells (XXIX.8), Keats wrote that the coaches were as:

"Many as bees about a straw-capp'd hive,
When first for April honey into faint flowers they dive.

He also described in Endymion "a bee bustling down in the blue-bells", and the bees humming "about globes of clover and sweet peas". Further, in I Stood Tip-Toe Upon a Little Hill, he pictured:

"A bush of May flowers with the bees about them;
Ah, sure no tasteful nook would be without them;".

Another attractive description of the bees in spring was embodied in the following verse in a poem by the modern author Maurice Baring, entitled Diffugere Nives, 1917, To J.C.S.

"Now the brown bees about the peach-trees boom
Upon the walls;
And far away beyond the orchard's bloom
The cuckoo calls."

Like all other living creatures the honeybee is

subject to the attacks of disease and predacious enemies. Among the latter are birds, rodents, predatory insects and spiders. An allusion to the depredations of the last-named creatures is to be found in Edmund Spenser's Amoretti (LXXI.2):

"Your selfe unto the Bee ye doe compare;
And me unto the Spyder, that doth lurke
In close awayt, to catch her unaware;".

Several diseases affect bees, of which "foul-brood" caused by bacteria attacks the larvae, and the "Isle of Wight disease" caused by mites destroys the adults. The latter is reported to have wiped out a lot of old English stock. The mites get into the tracheae of the bees and suffocate them. It is commonly spread by the worker bees pillaging stores from weak hives where the disease is present. An old English folk rhyme states that:

"If your bees fall sick, and pine, and die,
One of your house will soon in churchyard lie."

Fortunately there is no truth in this unpleasant superstition.

Before leaving the honeybees there are two more allusions deserving of mention. According to the Oxford Dictionary, to have a bee in one's bonnet is to be mad on some point. Something of the sort is implied in these lines from Herrick's Mad Nan's Song:

"For pitty, Sir, find out that Bee
Which bore my love away
I'le seek him in your Bonnet brave,
I'le seek him in your eyes."

It is a far cry from the calm rustic scene usually

brought to mind by the bee, to the noisy, thrumming, light-stabbed, night sky, flecked by streaking German planes over an English city, but that Herbert Palmer thought of the bees on such an occasion is told in the following stanza from his Air Raid: 1917-1918:

"I never feel more cheerfulness
Than when the German raiders fly
Like bees across the cloudless sky.
And neither pity, pain nor terror
Will ever wean me from my error."

But it seems improbable that the poet would continue to have similar feelings amid the horrors of the 1940-41 German air raids over England.

Family Bombidae: The Bumble or Humble Bees.

These are medium to large sized bees with robust, rather square cut bodies, densely covered with hair, and coloured yellow and black. They thrive in temperate climates, where they are well known because of their conspicuous appearance and noisy flight. The mention of a "furry coat" in Oscar Wilde's Her Voice indicates that he probably meant a bumble-bee.

"The wild Bee reels from bough to bough
With his furry coat and his gauzy wing,
Now in a lily cup, and now
Setting a jacinth bell a-swing,
In his wandering."

In truth the bumble-bee is extremely industrious and plays a vital role in the fertilization of red clover and other plants with blossoms having long tubular corollas in which the nectar

cannot be reached by shorter tongued bees.

A hint of the bumble-bee's hard working life is contained in the following descriptive lines from Coleridge's, This Lime-Tree Bower My Prison:

> "Through the late twilight: and though now the bat
> Wheels silent by, and not a swallow twitters,
> Yet still the solitary humble-bee
> Sings in the bean-flower!"

Two genera are recognized in this family, of which Bombus includes the social, nest-building bumble-bees that, like the honeybees, have three castes, the queens, males, and workers, the latter being the most abundant. Unlike the honeybees, however, the winter is passed only by fertilized young queens, hibernating in some protected place, where they may remain in a torpid condition as long as nine months. Like the field mouse whose nest she sometimes occupies, the bumble-bee the following spring or early summer, constructs her nest of soft grass or moss in the shape of a hollow ball, either underground or on the surface hidden among grass or herbage. Bearing this in mind, it may have been the bumble-bee that James Hogg, the Scottish shepherd poet, had in mind when he wrote the following stanza in Boy's Song:

> "Where the mowers mow the cleanest,
> Where the hay lies thick and greenest,
> There to track the homeward bee,
> That's the way for Billy and me."

In any event, in view of the habits of the bumble-bees, it seems likely that haymaking operations would often disturb or reveal the nests of these useful insects.

The queen, being the sole survivor of the winter, does all the work of the developing colony in the spring until the workers emerge, when they take over her duties. Her hind legs are equipped with pollen baskets, that enable her to collect a heap of pollen which she works into a paste in the centre of the nest, constructs on it a waxen cell and deposits in the latter her first batch of eggs. She also makes a waxen honey-pot near the entrance to the nest, which she fills to provide her with sustenance during inclement weather and while incubating her brood. Presumably the honey matures from nectar carried to the nest in the insect's crop, and the wax is secreted from hypodermal glands in the abdomen, as in the case of the honeybee. Information on such matters was very meagre and unreliable in Shakespeare's day, so it is not surprising that the great bard erred in some details in his allusions to insects. Two such misconceptions are revealed in the following references to the "honey-bag" and "waxen thighs" of the humble-bee in Midsummer Night's Dream. In Act III, Scene I, Titania instructs her attendant fairies to:

> "The honey-bags steal from the humble-bees,
> And, for night tapers, crop their waxen thighs,"

and in Act IV, Scene I, Bottom with his ass's head gives orders to one of the fairies, saying:

> "Mounsieur Cobweb, good Mounsieur, get your weapons in your hand, and kill me a red-hipped humble-bee on the top of a thistle; and good Mounsieur, bring me the honey-bag.... and have a care the honey-bag break not;".

To return to the life-history of Bombus: the eggs laid by the queen hatch, and the larvae feed upon the pollen paste and additional supplies of pollen and nectar brought to them by the queen, until finally they weave cocoons, pupate, and emerge in the form of workers, about three weeks from the time that the eggs were deposited. Several hundreds of eggs may be laid by the queen during the active season, towards the end of which queens and males are produced, the males being short-lived, but the surviving females carrying the species through the winter.

Because of its work in fertilizing the flowers the bumble-bee is a good friend of man, but it can inflict a severe sting if disturbed. Shakespeare knew of this, and also that because the sting is barbed it might be left in the wound and cause the death of the bee. This is shown in the words of Pandarus, Cressida's uncle, in Troilus and Cressida (V.10):

> "Full merrily the humble-bee doth sing,
> Till he hath lost his honey and his sting;
> And being once subdued in armed tail,
> Sweet honey and sweet notes together fail."

Actually, of course, Shakespeare's bee must have been a female or worker, as the male cannot sting.

The fear that little children often have for the stinging hymenoptera is revealed in one of the nursery rhymes published in the "Book of Knowledge" (37) which runs:

"I love the little flowers;
I love the little plants;
I love the little butterflies,
And I'm not afraid of ants.
But I do not love the bumble bee,
And the waspies really frighten me!"

And apparently sometimes even elderly people are annoyed by these furry benefactors, judging by the following rhyme from the same source:

"There was an old man in a tree,
Who was horribly bored by a bee;
When they said, 'Does it buzz?'
He replied, 'Yes it does!
It's a regular brute of a bee!'"

Before bringing this section to a close, brief mention should be made of the other genus of bumble bees, Psithyrus, which is parasitic in the nests of Bombus. These bees produce no workers, and the queen is unable to gather pollen. According to Sladen (51), who made detailed studies on the bumble bees in England, the Psithyrus queen enters the Bombus nest, stings the queen to death, and has her offspring reared by the Bombus workers.

Family Vespidae: The Wasps and Hornets.

"Th' envenom'd wasp, victorious, guards his cell;".
- Third Epist. to R.G. of F: Burns.

The wasps and hornets, both social and solitary, comprise another vast company of stinging insects. Imms (30) lists and discusses twelve families, but the majority of the allusions in English poetry and drama appear to relate only to one of these, Vespidae, which happens to be the largest and

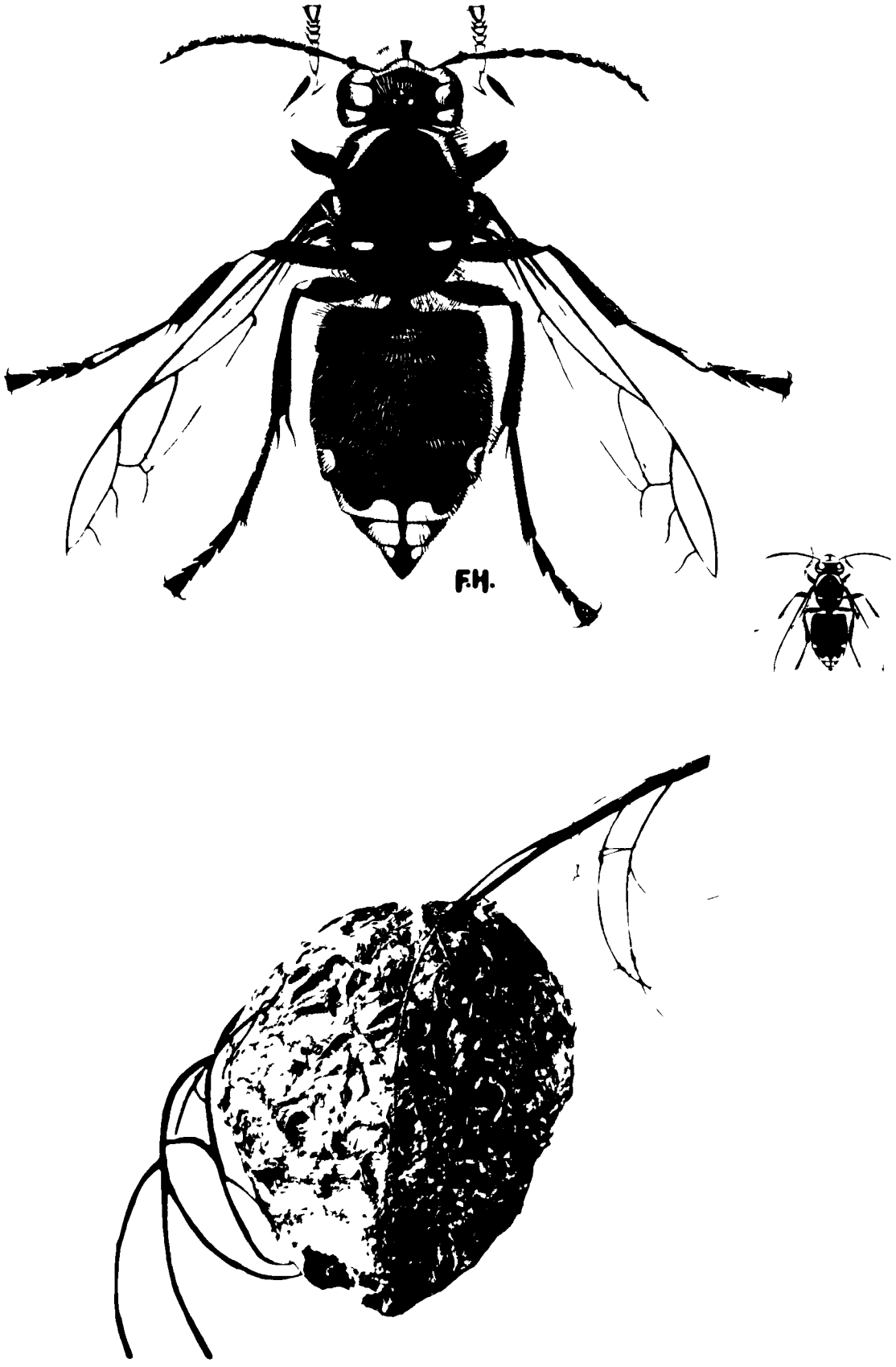

PLATE V - Above: white-faced hornet, enlarged and natural size
Below: nest of same, reduced (after Gibson and Twinn).

Hornets are mentioned on several occasions in the Bible, chiefly on account of their formidable stings and the fear they inspire in man and animals. Thus in Exodus (XXIII.28) we read: "I will send hornets before thee, which shall drive out the Hivite, the Canaanite, and the Hittite from before thee."; also, in Deuteronomy (VII.20): "Moreover the Lord thy God will send the hornet among them, until they that are left, and hide themselves from thee, be destroyed"; and in Joshua (XXIV.12): "I sent the hornet before you, which drove them out before you, even the two kings of the Amorites: but not with thy sword, nor with thy bow."

Milton, in Samson Agonistes, tells that blind Samson in captivity bemoaned:

> "Ease to the body some, none to the mind
> From restless thoughts, that like a deadly swarm
> Of hornets armed, no sooner found alone,
> But rush upon me thronging."

In England there is a large yellow and brown social hornet called Vespa crabro, which usually nests in hollow trees. It is sometimes referred to as the giant hornet, for it measures from three-quarters of an inch to nearly an inch in length, and can inflict a painful sting. Wilbur (67, p.283) records the following from an old English ballad, which contains what appears to be an excellent description of this formidable and truculent robber:

> "A Hornet zet in a hollow tree--
> A proper spiteful twoad was he--
> And a merrily zing while a did zet
> His stinge as zharp as a bayonet;
> 'Oh, who's so bowld and vierce as I?
> I vears not bee nor waspe nor vly'."

Although the hornets and wasps of this family are very fond of sweet things such as ripe fruit, honey-dew, etc., they also like meat, and are predacious and feed their larvae on animal matter including other insects. As many of the latter are noxious pests, the wasps thus perform a useful service. However, when the hornet and the wasp, probably the common yellow jacket, attended the Butterfly's Ball and the Grasshopper Feast, they must have temporarily overcome their natural instinc for we read:

"And there came the Moth,
With her plume of down
And the Hornet with jacket
Of yellow and brown.

"Who with him the Wasp,
His companion did bring,
But they promised that evening
To lay by their sting."

The wasp or common yellow jacket, which also belongs to the genus Vespa, is a sinister looking creature with its black and yellow markings. As with other species of Hymenoptera it is only the queens and workers that sting. The males are harmless, short-lived, and have only one function: to fertilize the females. But the stinging wasp is a creature of uncertain temper, as is vividly described in the words of the shepherd by Christopher North, published in Blackwood's Edinburgh Magazine, October, 1826:

> "O' a' God's creturs the wasp is the only ane that's eternally out o' temper. There's nae sic thing as pleasin' him. In the gracious sunshine... when the

bees are at work murmurin' in their gauzy flight, although no gauze indeed be comparable to the filaments o' their woven wings, or, clinging silently to the flowers, sook, sookin' out the hiney-dew, till their verra doups dirl wi' delight, --when a' the flees that are ephemeral, and weel contented wi' the licht and the heat o' ae single sun, keep dancin' in their burnished beauty, up and down, to and fro, and backwards and forwards, and sideways, in millions upon millions, and yet are never joistling anither, but a' harmoniously blended together in amity, like imagination's thochts,-- why, amid this 'general dance of minstrelsy', in comes a shower o' infuriated wasps, red het, as if let out o' a fiery furnace, pickin' quarrels wi' their ain shadows-- then roun' and roun' the hair o' your head, binnin' against the drum o' your ear till you think they are in at the ae hole and out at the ither--back again after makin' a circuit, as if they had repentit o' lettin' you be unharmed, dashin' against the face o' you who are wishin' ill to nae livin' thing, and although you are engaged out to dinner, stickin' a lang poishoned stang in just below your ee, that afore you can rin hame frae the garden swells up to a fearsome hicht, makin' you on that side look like a blackamoor, and on the opposite white as death, sae intolerable is the agony frae the tail o' the yellow imp that, according to his bulk, is stronger far than the dragon o' the desert."

In Visions of the World's Vanitie (X.7), Edmund Spenser wrote of the mighty lion "his strength his pride, and all his glory in his cruell clawes" being successfully attacked by a wasp.

"I saw a wasp, that fiercely him defide,
And had him battaile even to his jawes;
Sore he him stong, that it the blood forth drawes,
And his proude heart is fild with fretting ire:

. . . . .

"So weakest may anoy the most of might!"

Imms (30, p.599) states that many tropical species of wasps are fierce and easily aroused and their stings sometimes have

dangerous effects on animals and man. Spenser contrasted the wasp's vicious temperament with that of the milder honeybee, in The Faerie Queene (XVIII). The two characters Displeasure and Pleasaunce "He looking lompish and full sullein sad" and "she chearful, fresh, and full of joyaunce glad":

"An angry waspe th' one in a viall had,
Th' other in hers an hony lady-bee."

Chaucer appears to have made only one mention of the wasp, and that in a metaphorical sense; thus in the Prioress' Tale (L.1749):

"Our first foe, the serpent Sathanas
That hath in Jewes herte his waspes nest,".

Shakespeare used the wasp as a telling simile on several occasions. For example, witness the following dialogue between Petruchio and Katherina in The Taming of the Shrew (II.1).

Pet. "Come, come, you wasp; i' faith you are too angry."
Kath. "If I be waspish, best beware my sting."
Pet. "My remedy is then, to pluck it out."
Kath. "Ay, if the fool could find it where it lies."
Pet. "Who knows not where a wasp doth wear its sting?
In his tail."

Again, in Titus Andronicus (II.3), Queen Tamora urges her sons to murder Lavinia, after ravishing her, with the words:

"When ye have the honey ye desire,
Let not this wasp outlive us both to sting."

A very unpleasant way of dying by the aid of the wasp is described in The Winter's Tale (IV.3):

"He has a son, who shall be flayed alive, then,
'nointed over with honey, set on the
head of a wasp's nest."

Some wasps attack and kill honeybees and provision their nests with them to nourish their young. Henri Fabre (21) has described how the species Philanthus triangulum F., which belongs to the family Philanthidae, stings the bee into helplessness and then, by squeezing the thorax in its strong jaws, forces out any nectar or honey that may be in the crop and laps it up. Perhaps it was some such wasp that was "the strange hornet" referred to in the following lines from The Parliament of Bees by John Day:

> "There's the strange hornet, who doth ever weare
> A scalie armor and a double speare
> Coucht in his front: rifles the merchants packs
> Upon the Rhode; your honey and your waxe
> He doth by stealth transport to some strange shoare,
> Makes rich their hives and keeps your own groves poor."

The morphology and biology of the wasp are incorrect but the idea of brutal pillage is there. Another similar allusion occurs in Two Gentlemen of Verona (I.2), wherein Julia, after tearing up Proteus' letter, regrets doing so and exclaims:

> "Oh! hateful hands, to tear such loving words!
> Injurious wasps, to feed on such sweet honey
> And kill the bees that yield it with your stings!"

Wasps are frequently found about beehives, but apparently it is not common for them to raid the hives for honey. Shakespeare, however, pictured such a happening in The Rape of Lucrece, as follows:

> "In thy weak hive a wandering wasp hath crept,
> And suck'd the honey which thy chaste bee kept."

The nests of wasps vary in form and situation according to species. Some are constructed underground in

tunnels or cavities in the earth, and others above ground attached to shrubs and trees, or in or on the walls and roofs of buildings. Some are made of mud, and many others of paper which the wasps prepare by rasping fragments from wood and mixing them with saliva. It is particularly annoying to have wasps nesting about the house as they greatly resent any disturbance and will sting the occupants on slight provocation. That was what the puritanical Ananias evidently had in mind, in Ben Jonson's Alchemist (V.5.116), when, furious at being denied permission to take the goods from Lovewit's cellar that he and Tribulation had purchased with fraudulent intent, he shouted:

"... may dogs defile thy walls,
And wasps and hornets breed beneath thy roof,".

The underground type of wasp nest was referred to by Keats in Teignmouth, a description of the Teignmouth countryside sent to his friend Benjamin Haydon in a letter dated March 23, 1818:

"There's the Barton, rich
With dyke and ditch
And hedge for the thrush to live in
And the hollow tree
For the buzzing bee
And a bank for the wasp to hive in."

The British paper-making wasps are all social species living together in colonies made up of the queen, drones and workers. They do not store honey, and the entire colony dies at the end of the season, with the exception of the young impregnated females which hibernate through the winter. The

next spring each of the queens seeks out a likely spot, either above or below ground, according to the habits of the species, and commences constructing a nest. The first batch of grubs to hatch out in the hexagonal larval cells are tended and fed by the queen with masticated insects, and all emerge as workers. These take over the duties of nest construction and care of the young, while the queen concentrates on egg laying, so that as the season progresses the colony may number many thousands. Great numbers of flies and other insects must be killed by the worker wasps to feed the innumerable grubs. Walter De La Mare, in The Fly, looked sympathetically through the compound eye of a fly and found that to the latter the wasp is a very terrifying creature indeed.

"A loaf of bread a lofty hill;
A wasp, a cruel leopard,
And specks of salt as bright to see
As lambkins to a shepherd."

As the wasps' colony grows the nest has to be enlarged. The manufacture of paper involves considerable labour for the workers, so when opportunity presents they are apt to help themselves to the manufactured article. An allusion to this practice is to be found in Robert Browning's Pippa Passes (L.265):

"A fig-tree curled out of our cottage wall;
They called it mine, I have forgotten why,
It must have been there long ere I was born:
Cric - cric - I think I hear the wasps o'erhead,
Pricking the papers strung to flutter there
And keep off birds in fruit-time--coarse long papers,
And the wasps eat them, prick them through and through.

Periodically in England outbreaks of yellow jacket wasps occur in summer and are a great nuisance, especially where sweet or fermenting liquids or foods are exposed. These wasps also attack fruit ripening in the orchards and may do material damage unless checked. One seventeenth century method of protecting the fruit from wasps is given in John Phillips' poem Cyder, as quoted from Walton (60):

> "... let every bough
> Bear frequent vials, pregnant with the dregs
> Of Moyle, or Mum, or Treacle's viscous juice;
> They by the alluring odor drawn, in haste
> Fly to the dulcet cates, and crowding sip
> Their palatable bane; joyful thou'lt see
> The clammy surface all o'erstrown with tribes
> Of greedy insects that with fruitless toil
> Flap filmy perrons oft to extricate
> Their feet, in liquid shackles bound, till death
> Bereave them of their worthless souls."

Family Ichneumonidae: The Ichneumon Flies.

There is a great superfamily of insects made up of several families of parasites which appears to have been largely overlooked by the English poets and dramatists, but nevertheless is of prime importance in maintaining biological control in the insect world, and incidentally is of immense benefit to mankind. One of the most important of these families comprises the ichneumon flies which range in size from very small to large, some of the latter being conspicuous insects with remarkably long ovipositors, which can be forced through bark and the solid wood of trees to reach insect grubs boring within. Erasmus Darwin described the parasitism of a

caterpillar by an ichneumon fly in The Origin of Society:

"The wing'd Ichneumon for the embryon young
Gores with sharp horn the caterpillar throng,
The cruel larva mines its silky course,
And tears the vitals of its fostering nurse."

This roughly outlines the life-history of these typical parasites. The "sharp horn" mentioned undoubtedly refers to the female ovipositor or egg-laying tube. Usually the parasitized insect continues to live until the parasites have completed their development. Death of the host commonly occurs when they leave it

Eggs and pupae, as well as larvae are attacked by parasites. In comparatively recent years man has fostered the parasites of some of the more important insect pests of forests and crop plants by introducing suitable species from abroad, and propagating and liberating them where the pests are most numerous. Although the work is in its infancy there have already been some notable successes from biological control especially in the British Empire and the United States.

Family Cynipidae: The Gall Wasps.

Most of the species in this family are very small, dark coloured insects, which produce galls in living plants for the protection and sustenance of their maggot-like larvae. The eggs are laid in the tissues of the plant and galls form. The larvae develop and pupate within the closed galls and small exit holes have to be made by the insects to allow the tiny winged adults to escape. Oak trees are especially subject to

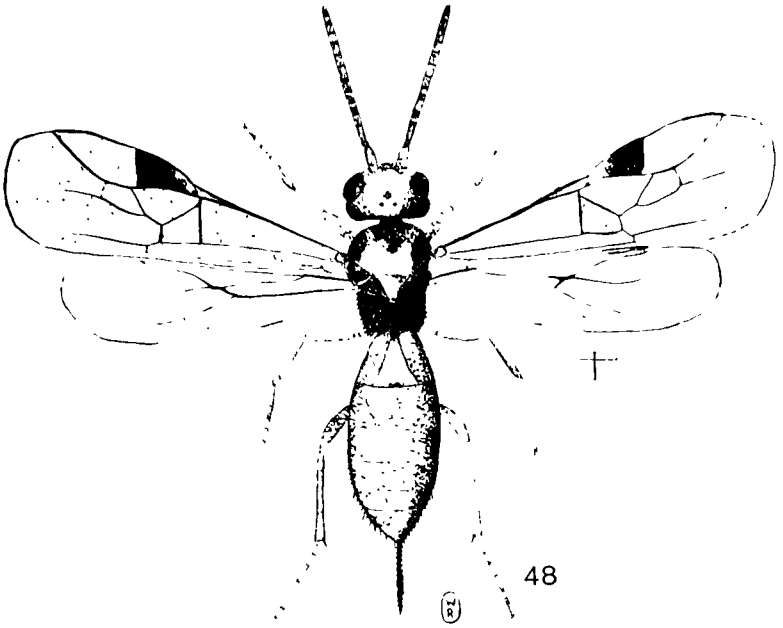

PLATE VI - Above: Microbracon parasite of meal moth, much enlarged (after Richards and Hereford). Below: tomato worm with cocoons of parasite, Apanteles congregatus say.

the attacks of gall wasps, and this has been recorded in the works of at least two English poets. In Tennyson's The Talking Oak, the oak assures the lover that, compared with many a group of beauties he had sheltered,

> "I swear (and else may insects prick
> Each leaf into a gall)
> This girl, for whom your heart is sick,
> Is three times worth them all;".

This allusion may be to a very common gall on oaks in England caused by a species known as Neuroterus lenticularis. This species exhibits a remarkable phenomenon, common to many gall wasps, in which only the alternating generations are alike; that is, one generation consists of males and females which reproduce sexually, and the next consist only of agamic (sexually inactive) females, which nevertheless lay eggs and give rise to true males and females, and so on. Furthermore, only the alternating generations resemble each other, the distinction being so great that in some forms the agamic and sexual generations were for some time believed to be different species.

The oak leaf galls referred to by Tennyson may have been those from which emerge the agamic generation. These galls, which are lens-shaped, are found on the lower surface of the leaves in autumn. The following spring the agamic females emerge and lay eggs, the larvae from which produce spherical galls: later, from these emerge males and females of very different appearance, and these mate and lay eggs,

causing the formation of the lens-shaped (lenticular) galls. Thus the cycle is repeated.

The spherical galls are commonly called oak apples. Browning evidently meant these when, in Caliban Upon Setebos, he wrote of:

> "... the pie (magpie) with the long tongue
> That pricks deep into oakwarts for a worm,
> And says a plain word when she finds her prize,".

It is an interesting fact that the galls produced by the gall wasps are so characteristic in location and form, that the insects which cause them may be identified by an examination of the galls alone.

CHAPTER IX

Order Diptera: The Two-Winged Flies and Fly-borne Disease.

"Go where his pickets hide--
Unmask the shapes they take,
Whether a gnat from the waterside,
Or stinging fly in the brake,
Or filth of the crowded street,".

The Spies' March: Kipling.

Death's pickets referred to by Kipling in this poem, which was inspired by an outbreak of plague in Manchuria, are the disease-carrying diptera, especially mosquitoes and house flies, of which the former breed in stagnant water and the latter in the "filth of the crowded street" or elsewhere. Typhoid and dysentery are prominent among the diseases carried mechanically by the house fly, and the blood-sucking flies transmit some of the worst scourges of mankind: malaria and yellow fever by mosquitoes; African sleeping sickness by tsetse flies, to name a few of the most important. Other species attack domestic animals. These include such flies as warbles and bots, which spend their larval lives as internal parasites of cattle and horses, respectively, and the horse flies, stable flies and black-flies which suck the blood of man as well as of animals. Then there are the crop-destroying species, representative of which are the root maggots, gall gnats, fruit flies, and crane flies. Some flies, however, are harmless or even

beneficial as scavengers, while still others, such as the tachina, syrphus, and robber flies, are parasitic or predacious on insects, and are valuable allies of man in the war against insect pests.

As the name of the order indicates, dipterous flies have only one pair of membranous wings, the hind pair of other insects being represented by two slender knobbed organs called halteres. The mouthparts are suctorial and sometimes modified for piercing; the metamorphosis is complete. The number of species belonging to the order is large, probably more than 50,000 having been named. According to Imms (30, p.616) approximately 3000 named species of flies are known to occur in the British Isles. The order is composed of a considerable number of families, but less than a dozen appear to have been mentioned in English poetry and drama. As one would expect, the allusions are chiefly to flies that most commonly force their attention on man either by biting or annoying him, or by attacking his livestock. Few appealed to his aesthetic sense in the manner of the more conspicuous and ornamental butterflies.

Family Muscidae.

To this family belong the ubiquitous house fly, the stable or biting house fly, the horn fly of cattle, and the dreaded tsetse fly, carrier of African sleeping sickness. Of these the house fly is most widespread and abundant and,

in temperate regions, is probably the insect most dangerous to man.

The House Fly

"Flies come to feasts unasked."
Jacula Prudentum: Geo. Herbert.

Several species of flies may be found in and about dwellings but the true house fly, Musca domestica, as it was appropriately named by Linnaeus, is by far the most numerous. It was probably this species that was referred to in Exodus (VIII.20-24):

> "And the Lord said unto Moses, Rise up early in the morning, and stand before Pharaoh... and say unto him, Thus saith the Lord, Let my people go, that they may serve me. Else, if thou wilt not let my people go behold, I will send swarms of flies upon thee, and upon thy servants, and upon thy people, and into thy houses: and the houses of the Egyptians shall be full of swarms of flies, and also the ground whereon they are.... And the Lord did so; and... the land was corrupted by reason of the swarm of flies."

The house fly is world-wide in distribution and especially abundant in warm climates. The animal and human faeces and other refuse in which the larvae develop were probably at least as freely accessible to the insects in ancient Egypt as in modern times. So the scourge of flies would not be a new experience for the Egyptians. House flies are also common in temperate climates, such as in the British Isles, where they appear in largest numbers in summer and autumn.

It is only in comparatively recent years that the importance of the house fly as a disease carrier has been generally recognized. Chaucer apparently thought flies of little account, for he often used the word "flye" as a simile for something insignificant. In The Reeve's Tale (L.4192), for instance: "Aleyn answerde, 'I counte hym nat a flye,'" and in the Shipman's Tale (L.1361): "In no degree the value of a flye," and again in The Parliament of Fowls (L.501): "The goos seyde, Al this nys not worth a flye!". Robert Burns showed a similar lack of appreciation of the importance of the fly. In the Song O Phely he sang: "I care na wealth a single flie;" and in Song O Whistle: "Gang by me as tho' that ye car'd nae a flie:". In The Country Lass he crowed:

"For Johnie o' the Buskie-glen
I dinna care a single flie;".

The reason that house flies are a serious health menace is that they frequent and breed in manure, human faeces, and garbage, and pass directly from such materials to food-stuffs, carrying organisms, pathogenic and otherwise, on their hairy bodies and appendages, and in their saliva and excretions, which they deposit wherever they happen to be feeding or resting. James Thomson, in The Seasons - Summer, written in the early part of the eighteenth century, showed in the following lines that he was aware of the house fly's fondness for human food:

"... some to the house,
The fold, and dairy, hungry, bend their flight,
Sip round the pail, or taste the curdling cheese:
Oft, inadvertent, from the milky stream
They meet their fate; or weltering in the bowl,
With powerless wings around them wrapt, expire."

The natural instinct of a child to turn away in disgust from milk in which a fly has fallen is a healthy one, and should be commended, for millions of bacteria are almost sure to develop in this excellent culture media from such pollution. The contaminating effect of flies was mentioned in the Bible (Ecclesiastes, X.1), in the words:

"Dead flies cause the ointment of the apothecary to send forth a stinking savour."

Clean, hygienic cities, towns and villages are a comparatively recent development made possible by modern engineering skill and applied science, coupled with improved municipal government and a public more generally aware of the relationship between dirt and disease. Curtis (14) has described London in earlier times. This author states that "for the most part the streets were narrow, and filthy.... At the end of the sixteenth century some ineffectual attempts were made to better the dreadful condition of the streets, but it was not until late in the eighteenth century that there was any great improvement. They were full of ruts and holes.... Down the centre of the streets ran a gutter, or kennel, which was used as a common drain. Into this was flung refuse of every kind.... Garbage and refuse from fruit stalls and butchers' shops were flung into the gutter to lie in the

stagnant water and putrefy until some heavy rainstorm would... sweep the unsavoury refuse towards the river...." What a paradise for flies and vermin! Under such conditions flies must have been a terrible nuisance. The situation undoubtedly was further aggravated by plentiful accumulations of horse manure, the house fly's favourite breeding place, as the horse was the principal source of power for transport before the modern development of the internal combustion engine.

Shakespeare and his contemporaries reveal that they were familiar with the house fly nuisance by several allusions to the pest. Here is an example from Spenser's Faerie Queene (II.IX.51):

> "And all the chamber filled was with flyes,
> Which buzzed all about, and made such sound
> That they encombred all men's eares and eyes,".

George Herbert, who was quoted at the beginning of the section, noted that;

> "To a boiling pot flies come not.",

and Barnabe Googe, one of the lesser poets of the latter part of the sixteenth century, recorded the following homely observations, which were followed by the conclusion that the fly is better off than the poet because it is without reason and "therwith voyde of woe":

> "Ons musynge as I sat,
> and Candle burnynge by,
> When all were husht I might discern
> a symple selye Flye.
> That flewe before myne eyes,
> with free rejoysynge Hart,
> And here and there, with wings did play

"As voyde of pain and smart,
Somtyme by me she sat,
when she had played her fyll,
And ever when she rested had
about she flyttered styll."

Shakespeare shows knowledge of the association of flies with filth by calling them carrion-flies, in Romeo and Juliet (III.3). The words he put into the mouth of Romeo when protesting to Friar Laurence against the punishment of banishmer also indicate that flies were an intimate and accepted nuisance about one's person, thus:

"More honourable state, more courtship lives
In carrion-flies than Romeo: they may seize
On the white wonder of dear Juliet's hand,
And steal immortal blessing from her lips;
... But Romeo may not; he is banished:
Flies may do this, but I from this must fly;".

Even in these comparatively enlightened times, in North America at least, farm homes are not uncommon where myriad flies, bred in the careless manure pile near the stables, invade the dining room and kitchen and share the food with other guests. It is not to be wondered at then, if the unscreened homes of Shakespeare's England were the haunt of flies in the summer time. Shakespeare drew freely on his native experience in depicting scenes in plays with an exotic locale. Thus, the house fly in the home had a role to play in Titus Adronicus (III.2). Marcus, in his brother Titus' house, while at table angrily struck a dish with his knife, whereupon the following dialogue occurred:

T. "What dost thou strike at, Marcus, with thy knife?
M. At that that I have kill'd, my lord,--a fly.
T. Out on thee, murderer! thou kill'st mine heart;
Mine eyes are cloy'd with view of tyranny:
A deed of death done on the innocent
Becomes not Titus' brother. Get thee gone;
I see thou art not for my company.
M. Alas! my lord, I have but kill'd a fly.
T. ... Poor harmless fly!
That with his pretty buzzing melody
Came here to make us merry! and thou hast kill'd him."

The fly, of course, was not harmless: it might have been carrying the germs of typhoid fever, tuberculosis, or of summer diarrhoea, the latter a prevalent and sometimes fatal complaint, especially of young children. As to typhoid fever, the oldest son of James I is reported to have succumbed to this disease when still a boy. It has killed and enfeebled countless others through the centuries, and the house fly has played an important part in spreading it by alternatively visiting human faeces and food. Typhoid used to be a major source of casualties in war, such as in the Spanish-American and the Boer wars, but nowadays soldiers are immunized to it by injection of an effective serum. Tennyson, in The Defence of Lucknow (VI.10) described the:

"Stench of old offal decaying, and infinite
torment of flies,"

and thus stressed the abundance and importance of these two-winged pests under war conditions in hot climates.

Flies themselves are subject to disease. They are often found sluggish, dead or dying of a fungus, especially in the autumn. Doubtless they were sick flies that the Duke of Burgundy mentioned to King Henry in Henry V (V.2) when advising

him in the matter of winning the hand of the French princess, Katherine, as follows:

> "... maids well summered and
> warm-kept, are like flies at
> Bartholomew-tide, blind, though
> they have their eyes; and then they
> will endure handling,".

Several writers have used the activities of the house fly to point a moral. Here is an example from John Gay's well-known Beggar's Opera (II.1):

> "The fly that sips treacle is lost in the sweets,
> So he that tastes woman, woman, woman,
> He that tastes woman, ruin meets."

His contemporary, William Oldys, drew this lesson On a Fly drinking out of a Cup of Ale:

> "Busy, curious, thirsty fly,
> Drink with me, and drink as I!
> Freely welcome to my cup,
> Could'st thou sip and sip it up;
> Make the most of life you may;
> Life is short and wears away."

Fermented liquids are very attractive to flies, and beer has often been used successfully in baiting fly traps. They must have been a nuisance to the habitues of the English taverns and inns in the summer, but they were too often treated with tolerance and even sympathy as familiar companions sharing homely comforts. Such an attitude towards them is exhibited in several poems on the fly written by John Wolcot under the pen name of "Peter Pindar", and brought together by Weiss (61). Here is one on The Drunken Fly:

"Poor little reeling, thoughtless soul,
To tumble drunk into the bowl!
Death to thy thread had clapped his knife;
Go, wipe thy nose, and wings, and thighs,
And brighten up thy maudling eyes,
And thank the captain for thy life!

"In future, get not quite so drunk!
Thy girl, perhaps a lass of spunk,
May wish thy amorous powers to prove;
And should'st thou, drunk, the wanton chase,
Ebriety may bring disgrace;
And who would look a fool in love?"

In another, To a Fly taken out of a bowl of punch, Wolcot moralises on human frailties:

"Ah! poor intoxicated little knave,
Now senseless, floating on the fragrant wave;
Why not content the cakes alone to munch?
Dearly thou pay'st for buzzing round the bowl:
Lost to the world, thou busy sweet-lipped soul--
Thus Death, as well as Pleasure, dwells with Punch.

"Now let me take thee out, and moralise.--
Thus 'tis with mortals, as it is with flies,
For ever hankering after Pleasure's cup:
Though Fate, with all his legions, be at hand,
The beasts, the draught of Circe can't withstand,
But in goes every nose--they must, will sup."

By alluding to the fly as "sweet-lipped" Wolcot showed that he had no conception of its true character, and probably drank his punch without a qualm. Actually, the term "foul-lipped" would be more appropriate. The mouthparts of the house fly are pad-shaped at the tip and are used for feeding upon excrement, sputum, exudations from sores and other unpleasant substances, as well as human food. Moreover, in order to dissolve soluble foods such as sugar, the fly moistens them with saliva regurgitated from its crop, and polluted with

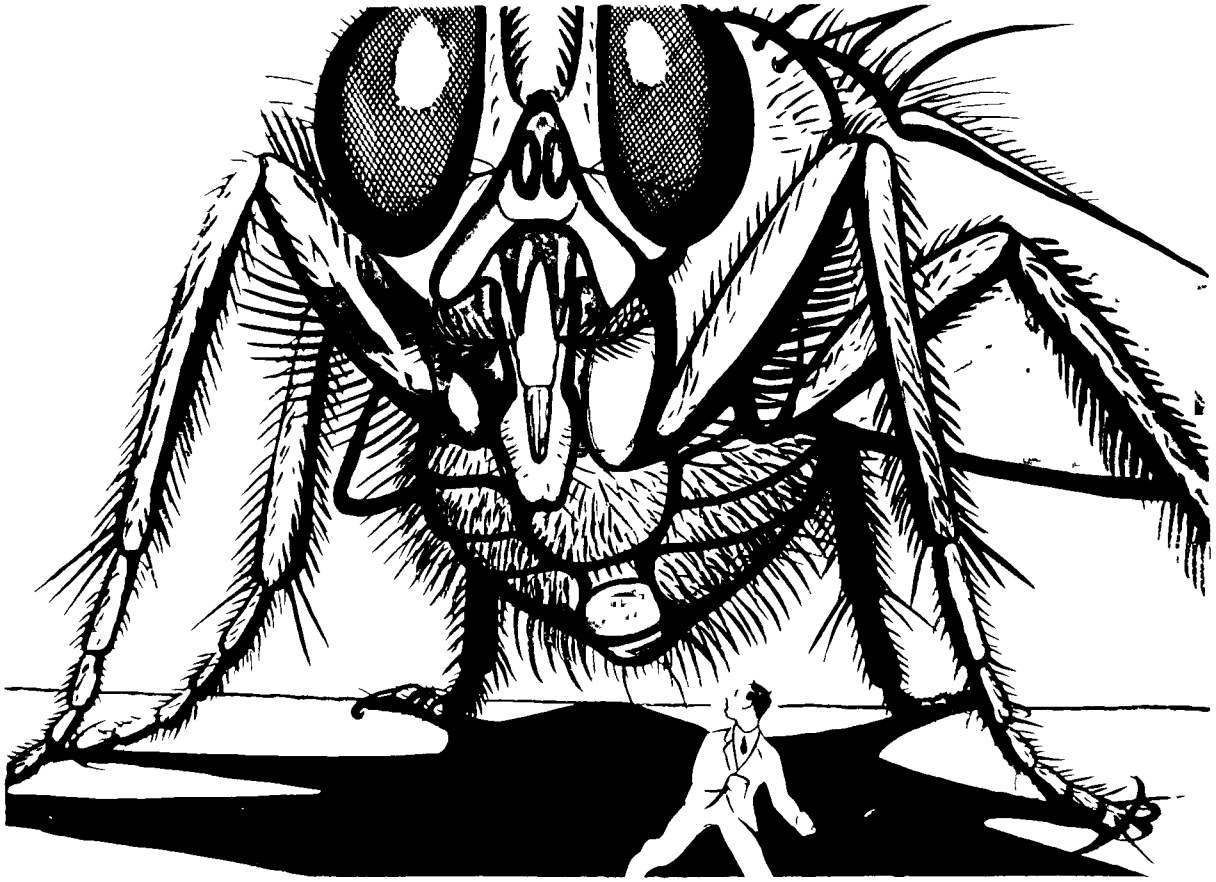

PLATE VII - The house fly menace. Drawing by Hennessey (after Gibson).

bacteria from previous feedings. Wolcot's amusing piece on The Toper and the Flies shows, however, that there was some revulsion to drinking liquids in which flies had drowned:

"A group of topers at a table sat,
With punch that much regales the thirsty soul:
Flies soon the party joined, and joined the chat,
Humming, and pitching round the mantling bowl.

"At length those flies got drunk, and for their sin,
Some hundreds lost their legs, and tumbled in;
And sprawling 'midst the gulph profound,
Like Pharaoh and his daring host, were drowned!

"Wanting to drink--one of the men
Dipped from the bowl the drunken host,
And drank--then taking care that none were lost,
He put in every mother's son agen.

"Up jumped the Bacchanalian crew on this,
Taking it very much amiss--
Swearing, and in the attitude to smite:--
'Lord!' cried the man, with gravely-lifted eyes,
'Though I don't like to swallow flies,
I did not know but others might.'"

The reference to "some hundreds" of flies shows how numerous they were. The fecundity of the house fly is amazing. The female may lay several batches of eggs, each batch containing 100 to 150, the total perhaps exceeding a thousand. These are deposited in refuse or excrement and, in warm weather, the larval and pupal stages may be completed and the flies emerge in two to three weeks. Thus there may be several generations during the summer season, each more numerous than the one preceding. Robert Browning, in Cleon, likened man's death to the metamorphosis of the fly:

"Freed by the throbbing impulse we call death,
We burst as the worm into the fly,
Who, while a worm still, wants his wings."

Another poet, Cowper, in The Task, compares the lives of men with that of the transient flies:

"Dreams, empty dreams. The millions flit as gay
As if created only like a fly,
That spreads its motley wings in th' edge of noon,
To sport their season and be seen no more."

Anyone who has looked closely at a fly will have noticed that its compound eyes are very large and occupy a considerable area of the head. These conspicuous eyes provide a simple means of distinguishing between the two sexes. In the female the eyes are set apart, but in the male the margins of the eyes lie close together and are said to be contiguous. The vision of the fly is rudimentary in comparison with that of humans. The eyes have no focussing mechanism and are incapable of clearly discerning the form of objects more than a few feet away, and the acuteness of vision would be only a small fraction of that of man even at the optimum distance. The compound eyes of insects, however, are specially adapted for prompt perception of movement, a faculty that enables them to avoid or escape their enemies. Walter De La Mare wondered what familiar objects look like to insects in his poem The Fly:

"How large unto the tiny fly
Must little things appear.
A rosebud like a feather bed,
Its prickle like a spear;

"A dewdrop like a looking-glass,
A hair like golden wire;
The smallest grain of mustard-seed
As fierce as coals of fire;".

House flies have natural enemies like most other living creatures, although, unfortunately, not enough to keep them in proper check. Tennyson, in The Poet's Song, mentioned one such when he wrote that the poet chanted a melody so loud and sweet that:

"The swallow stopt as he hunted the fly,".

Actually, during the summer season there is only one really effective measure to be taken against the prolific house fly, and that consists of clean-up and proper disposal of all potential breeding places such as horse manure, other excrement and organic matter. Of course, fly sprays, sticky fly papers, poisoned baits and fly swatters all help, and fly screens are indispensable, but the number destroyed is small when compared with those disposed of by prevention of breeding. Fortunately, the cold of winter makes a fairly clean sweep, or as Tennyson expressed it, in The Window: Winter:

"Bite, frost, bite!...
And the bees are still'd, and the flies are kill'd,"

and only a comparatively few of the latter survive until spring.

The Stable Fly and The Horn Fly

These flies are related to the house fly, but instead of lapping up liquid foods their mouthparts are adapted for piercing, and they are bloodsuckers. The stable fly, Stomoxys calcitrans L., is about the same size as the house fly, but can be readily distinguished from the latter by its slender piercing

proboscis which is held straight out in front of the face. It breeds in horse manure and rotting vegetation and attacks cattle, horses, and pigs, as well as man, who sometimes calls it the biting house fly and perhaps something stronger, when he is bitten by it in his bathing suit on lakeside bathing beeches. The horn fly, Lyperosia irritans L., is noticeably smaller, uniformly dark grey, and confines its attacks largely to cattle. When not feeding on the animal's blood these flies frequently rest in clusters on the base of the horns. The larvae develop in fresh cow manure.

It may have been one or both of these species, and perhaps mosquitoes and horse flies as well, that Edmund Spenser had in mind when he wrote in The Faerie Queene:

> "How many flies, in hottest summer's day
> Do seize upon some beast whose flesh is bare,
> That all the place with swarms do overlay
> And with their little stings right felly fare."

The persistent attacks of horn flies on patient cattle were described by the observant and nature loving James Thomson, in The Seasons: Summer:

> "Around the adjoining brook that purls along
>
> . . . . .
>
> "A various group the herds and flocks compose,
> Rural confusion! On the grassy bank
> Some ruminating lie; while others stand
> Half in the flood, and, often bending, sip
> The circling surface. In the middle droops
> The strong laborious ox, of honest front,
> Which, incomposed, he shakes; and from his sides
> The troublous insects lashes with his tail,
> Returning still."

These flies are endowed with an instinct or intelligence to avoid the switching tail of their tormented host. This they often do by congregating in largest numbers on the withers, which are largely beyond the reach of that organ. Fortunately their numbers soon decline in the chilly days of autumn.

Family Calliphoridae: The Blow Flies.

"The fairest flesh at last is filth on which
the worm will feast;".
Happy: Tennyson.

These flies are the rather large, noisy, metallic blue or green insects that are attracted to fresh or decaying meat, faeces, and other organic matter. Although they normally breed in carrion, certain of them will deposit eggs on animals and man, and, if conditions are suitable, the larvae may invade the living organs and tissues and produce a diseased condition known as myiasis. A case of myiasis is described in the Bible, in Job (VII.5):

"My flesh is clothed with worms...; my
skin is broken, and become loathsome."

An unspeakable hell is promised in Isaiah (LXVI.24) for all who transgress against the Lord:

"for their worm shall not die, neither shall
their fire be quenched; and they shall be an
abhorring unto all flesh."

Thus is shown that in very early times man was familiar with the activities of blow fly maggots.

In medieval England "green-bottle" flies (Lucilia spp.) and "blue-bottle" flies (Calliphora spp.) must have been very

plentiful in summer, especially in large communities like London, which at that period were existing under conditions of primitive hygiene and sanitation. According to Curtis (14) certain London streets still bear such names as Stinking Lane, Seething Lane, and Offal Court,legacies of earlier times when they were applied literally. Refuse from butchers' stalls, and filth and garbage of all kinds was thrown into the gutters running down the middle of the streets, and must have attracted hordes of blow flies and house flies in warm weather. This author states that the street called Houndsditch acquired its name from the fact that at one time it was a moat or ditch into which the citizens threw dead dogs and other noisome objects. As one would expect under such conditions, Chaucer was well acquainted with blow fly maggots or "wormes", as revealed in several of his works. Here is an allusion from The Cook's Prologue, to a fly-blown goose in a fly-ridden shop. The host addresses Roger the Cook thus:

"Of many a pylgrym hastow Cristes curs;
For thy persly they faren yet the wors,
That they have sten with the stubbil goos;
For in thy schoppe is many a flye loos."

He also knew something about the condition of maggot infestation called myiasis. A reference to this is found in The Monk's Tale, wherein is told how God punished King Antiochus for his crimes against the Jews. The word "wreche" in the first line means revenge:

"The wreche of God hym smot so cruely,
That thurgh his body wikked wormes crepte,
And therwithal he stonk so 'orribly,
That noon of al the meyne that him kepte,
Whether that he wook or elles slepte,
Ne mighte nought the stynk of hym endure."

Another graphic allusion to this unpleasant affliction occurs in Boethius (II.6), in the latter part of the following quotation:

"... whiche men wel ofte ben sleyn
with bytinge of smale flyes, or elles
with the entringe of creepinge wormes
into the privetees of mannes body."

It is possible, of course, that this type of myiasis was caused by species other than blow flies: the so-called flesh flies, for instance, that belong to the family Sarcophagidae, and deposit living larvae instead of eggs.

Shakespeare, too, knew of myiasis, as is revealed in Love's Labours Lost (V.2), wherein Biron, in love with Rosalind, apologizes to her for his flights of oratory and attempts to excuse himself with the statement that:

"... these summer flies
Have blown me full of maggot ostentation,";

and also in The Tempest (III.1) when Ferdinand, declaring his love for Miranda says that he:

"... would no more endure
This wooden slavery, than to suffer
The flesh-fly blow my mouth."

In all probability the latter refers to a species of Sarcophagidae, certain of which may, under appropriate conditions, cause myiasis in the cranial orifices. However,

the two groups of flies are closely related. What may refer to another type of blow fly infestation appears in Romeo and Juliet (I.4), wherein Mercutio describes Queen Mab's driver as a "grey-coated gnat, not half so big as a round little worm prick'd from the lazy finger of a maid:".

A species of green-bottle fly, Lucilia sericata Meigen, called the sheep-maggot fly, lays its eggs in soiled wool or wounds of sheep, and the maggots bore into the flesh and cause injury or death to the animals. This species is common in England and many parts of the world, and in Australia is of great importance. The maggots of these blow flies used to be called "gentils" or "gentles" in England. Kirby and Spence (31, p.33) quoted a passage from Thomas Tusser's works in which the latter gives good advice to sheep raisers on precautions to take against blow fly attacks:

> "Reward not thy sheep when ye take off his cote
> With twitches and patches as brode as a grote;
> Let not such ungentlenesse happen to thine,
> Lest fly with her gentils do make it to pine."

Other animals besides sheep may be "struck" by blow flies. For instance, wounds inflicted during farm operations such as dehorning, castrating, docking, etc., will attract egg-laying blow flies. Tennyson mentions this in Aylmer's Field (L.571):

> "Last, some low fever ranging round to spy
> The weakness of a people or a house,
> Like flies that haunt a wound, or deer, or men,".

Besides attacking living animal tissues, the blow flies and flesh flies are also scavengers, and breed in dead

and decaying meat and other organic matter. Human and animal corpses as well as butcher's meat become quickly infested when left exposed during the summer season. It has been estimated that as many as a million flies can be raised from the carcass of one cow, and over 40,000 from a sheep. Anyone who has smelt the odour from a corpse and observed the masses of writhing larvae feeding upon it will appreciate the following stanza from African Moonrise, by the modern English poet Roy Campbell:

"The wind with foetid muzzle sniffed its feast,
The carrion town, that lulled its crowds to rest
Like the sprawled carcass of some giant beast
That hives the rustling larvae in its breast."

Shakespeare and Shelley among English poets and dramatists appear to have alluded most often to this rather gruesome topic. In Cymbeline (IV.2), Imogen, thinking the headless body of Cloten is that of her husband, wishes to bury it before following Lucius. She said to him:

"I'll follow, Sir. But first, an't please the Gods,
I'll hide my master from the flies, as deep
As these poor pickaxes can dig."

Proud Cleopatra, in Antony and Cleopatra (V.2), preferring death to dishonour said to her triumphant captor, Proculeius:

"Shall they hoist me up and show me to the
shouting varletry of Rome? Rather a ditch
in Egypt be gentle grave to me! rather on
Nilus' mud lay me stark naked, and let the
water-flies blow me into abhorring!"

It is obvious from these allusions and the one to follow that Shakespeare was as familiar with the work of maggots in human

cadavers as any soldier from the wars, or the unfortunate inhabitants of battle-scarred regions of the world today. The people of Shakespeare's London were not unduly squeamish, and they probably viewed with indifference the row of heads of executed traitors impaled on long pikes, that graced Traitor's Gate on London Bridge. Doubtless these, too, supported maggots, the flies from which perhaps crawled over the good citizens' food exposed in neighbouring houses. To top which, here is a rather unsavoury selection from Hamlet (IV.3). The King asks of Hamlet the whereabouts of the Lord Chamberlain, Polonius, whom Hamlet has slain; and the latter replies:

> "At supper... not where he eats, but where he is eaten: a certain convocation of politic worms are e'en at him. Your worm is your only emperor for diet: we fat all creatures else to fat us, and we fat ourselves for maggots:... A man may fish with the worm that hath eat of a king, and eat of the fish that hath fed of that worm."

Robert Burns wrote an Epitaph on Wat, whose identity is unknown. Whoever he was he apparently inspired an undying hatred in the Scottish bard, if one may judge from the malignancy of this tribute:

> "Sic a reptile was Wat,
> Sic a miscreant slave,
> That the very worms damn'd him
> When laid in his grave.
> 'In his flesh there's a famine,'
> A starv'd reptile cries;
> 'An' his heart is rank poison,'
> Another replies."

The life-history of blow flies is rather similar to that of the house fly already described. The length of time

taken in developing from the egg through the larval and pupal stages varies with temperature conditions and may occupy from three weeks to more than a month. Pope, in Moral Essays (II.25-28), called blow flies:

> "... morning insects that in muck begun,
> Shine, buzz, and fly-blow in the setting sun."

They may live, however, for longer than a day or even a month; in fact they live for several months when hibernating through the winter.

Shelley appeared to think that all human corpses were fed upon by "worms" in the grave. This could only refer to fly maggots and not to earthworms, which favour a vegetable diet. Shelley made close to seventy allusions to worms in his poetry, most of which were probably blow fly larvae. Here are several examples. The first is from Falsehood and Vice:

> "Our joys, our toils, our honours meet
> In the milk-white and wormy winding-sheet:".

Another is from The Daemon of the World (II.220), when referring to a corpse, he writes:

> "To-day, the breathing marble glows above
> To decorate its memory, and tongues
> Are busy of its life: Tomorrow, worms
> In silence and in darkness seize their prey."

In Rosalind and Helen, Shelley really let himself go on this subject. Rosalind's father had died and she explained that:

> "When he was in the churchyard lying
> Among the worms, we grew quite poor,
> So that no one would give us bread:".

Later, the mother died and:

"When she was a thing that did not stir
And the crawling worms were cradling her
To a sleep more deep and so more sweet
Than a baby's rocked on its nurse's knee,
I lived:"

Actually, if the body of a deceased person is properly protected from egg-laying flies prior to deep and adequate burial there should be no infestation by dipterous maggots. The case of a corpse left exposed on the ground is a very different matter. The flies quickly find it and deposit their eggs upon it to multiply their kind, and the maggots feed upon it with a will and hasten the return of the frail flesh to mother earth. Shelley alluded to this in Prometheus Unbound (IV.313) when he wrote that the "jagged alligator" and the imaginary "êarth-convulsing behemoth" were once monarch beasts, and on slimy shores and weedy continents:

"Increased and multiplied like summer worms
On an abandoned corpse,".

Queen Mab (VIII.184) contains the statement that in the tropics man was subjected to slavery:

"Or he was lead to legal butchery
To turn to worms beneath that burning sun,".

In this same work there is a piece (III.143-9) that may refer to Napoleon, who was the European aggressor in Shelley's time, but is equally applicable to Hitler and like tyrants, and embodies a truth that should be a comfort to many in these perilous times:

"Ay! to-day
Stern is the tyrant's mandate, red the gaze
That flashes desolation, strong the arm
That scatters multitudes. To-morrow comes!
That mandate is a thunder-peal that died
In ages past; that gaze, a transient flash
On which the midnight closed, and on that arm
The worm has made his meal."

The following two lines from Tennyson's Vision of Sin might be taken as a brief description of a nineteenth century battlefield after the contesting armies had departed:

"Below were men and horses pierced with worms,
And slowly quickening into lower forms;".

But blow fly maggots not only dispose of the dead; certain species of them may aid the living. During the World War of 1914-1918 it was found that wounded men who were left for rather long periods unattended on the battlefield, and whose wounds became infested with maggots, failed to develop infections. This was because the maggots devoured dead tissues and prevented bacteria from multiplying. As a result of this experience, larvae of the blow flies Lucilia sericata and Phormia regina, reared aseptically, were used successfully in the treatment of osteomyelitis, a disease of the bone, and tuberculous abscesses. Subsequently the curative principle, allantoin, was extracted and identified from the maggots, so that now cures can be effected without implanting the larvae in the affected parts.

Besides the blow flies, the family Calliphoridae includes a species known as the cluster fly, Pollenia rudis Fab.

It is larger and darker in colour than the house fly, and its body bears many short yellowish hairs. In the autumn these flies enter houses to hibernate, and often make a nuisance of themselves on warm days in winter and in the spring by waking up and bumbling at the windows, or clumsily and noisily flying around lights. Perhaps it was this species that the Earl of Surrey alluded to in The Lover Describeth His Restless State. In this he wrote of his hopeless infatuation for Geraldine, Lady Elizabeth Fitz-Gerald, and pictured himself:

"... as the fly that see'th the flame,
And thinks to play her in the fire,".

Wordsworth's poem Written in Germany, on one of the Coldest Days in the Century deals chiefly with a fly awakened from hibernation by the warmth of the stove. This may have been a cluster fly:

"See that Fly, - a disconsolate creature! perhaps
A child of the field or the grove:
And, sorrow for him! the dull treacherous heat
Has seduced the poor fool from his winter retreat,
And he creeps to the edge of my stove."

An interesting feature about these flies is that their larvae develop as internal parasites of certain species of earthworms.

Family Culicidae: Gnats or Mosquitoes.

"Over the pools in the burn water-gnats
murmur and mourn."

Leonine Elegaics: Tennyson.

In the world at large, mosquitoes are one of the most economically important of insect families, because the females

are bloodsuckers and serve as the intermediate hosts of several very serious diseases of humans, including malaria, yellow fever, filariasis, and dengue or break-bone fever. Malaria has been known in the British Isles, but is more prevalent in warmer climates especially tropical regions, where the other diseases mentioned also have their range.

Between 1500 and 2000 species have been described in this world-wide family, the bulk of which occur in tropical regions. However, although the species are comparatively few in the colder parts of the globe, the number of individuals is enormous. There are less than 30 species in the British Isles, about 57 in Canada, and only two in the Arctic, but nevertheless they are very abundant and notorious bloodsuckers, especially in the latter two regions.

Mosquitoes are rather fragile, slender insects, with a long piercing proboscis, and narrow wings, the veins and posterior margins of which are fringed with scales. In England they are commonly called gnats and there are a number of allusions to them under this name in poetry and drama.

There appears to be only one clearly recognizable reference to them in the Bible. This occurs in the well-known passage in Matthew (XXIII) wherein Jesus says:

> "Woe unto you scribes and Pharisees, hypocrites! for ye pay tithe of mint and anise and cummin, and have omitted the weightier matters of the law, judgement, mercy and faith: these ought ye to have done, and not to leave the other undone. Ye blind guides, which strain at a gnat and swallow a camel."

The gnat was probably mentioned only because of its small size. Chaucer used it in the Mauncipleʼs Tale to show how small was the worth of the man that cuckolded his friend:

"'Phebus', quod he, 'for al thy worthyness,
For al thy beaute and thy gentiles,
For alle thy songes and thy menstralcie,
For al thy waytyng, blered is thin ye,
With oon of litel reputacioun,
Nought worth to thee as in comparisoun
The mountaunce of a gnat, so mot I thryve;
For on thy bed thy wif I saugh him swyve.'"

Shakespeare, too, used the gnat to illustrate something very small: in Cymbeline (I.3), when Imogen says that if she could have seen her lord sail away on his ship she would have followed him with her eyes:

"... till he had melted from
The smallness of a gnat, to air.",

and in The Rape of Lucrece (I.1014), wherein appears the statement that:

"Gnats are unnoted whereso'er they fly,
But eagles gaz'd upon with every eye."

In The Comedy of Errors (II.2), Shakespeare either referred to some other kind of insect, or was ignorant of the mosquito's biology. This allusion occurs when Antipolus of Syracuse, after beating his servant Dromio for jesting at his expense, warns him to be sure of his master's mood another time, for:

"When the sun shines, let foolish gnats make sport;
But creep in crannies, when he hides his beams."

Actually, although some species of mosquitoes may be active in the daytime, the majority prefer to do their flying, biting and mating at dusk or after dark.

Nowadays it is common knowledge that mosquitoes develop only in stagnant water, or in water that is no more than sluggishly flowing in a stream choked with plant life. Considerable variation exists in the types of breeding places, the duration of the life-stages, and the habits of the different species. In general, the female may lay several hundreds of eggs on water or in low places where water collects, and the larvae or "wrigglers" that hatch therefrom feed on minute life and organic matter, and obtain air by applying a tubular organ at the end of their tail to the water surface. The larvae eventually transform into comma-shaped, active pupae, which breathe through a pair of tubes on the back. When the mosquito is ready to emerge, air is taken into the pupal case causing it to float. It splits along the back, the mosquito crawls out and presently is able to fly away (vide Twinn).

These and many other elementary facts about mosquitoes were not known in Edmund Spenser's time, but this poet made several keen observations about them. In The Faerie Queene (I.1.23), the knight, while fighting a monster that had emerged from a cave in thick woods to confront him and his lady fair, is beset by the monster's "fruitful cursed spawne of serpents small" which he disposes of:

"As gentle shepheard in sweete eventide,
When ruddy Phebus gins to welke in west,
High on a hill, his flocke to vewen wide,
Markes which doe byte their hasty supper best;
A cloud of cumbrous gnattes doe him molest,
All striving to infixe their feeble stinges,
That from their noyance he no where can rest;
But with his clownish hands their tender wings
He brusheth oft, and oft doth mar their murmurings."

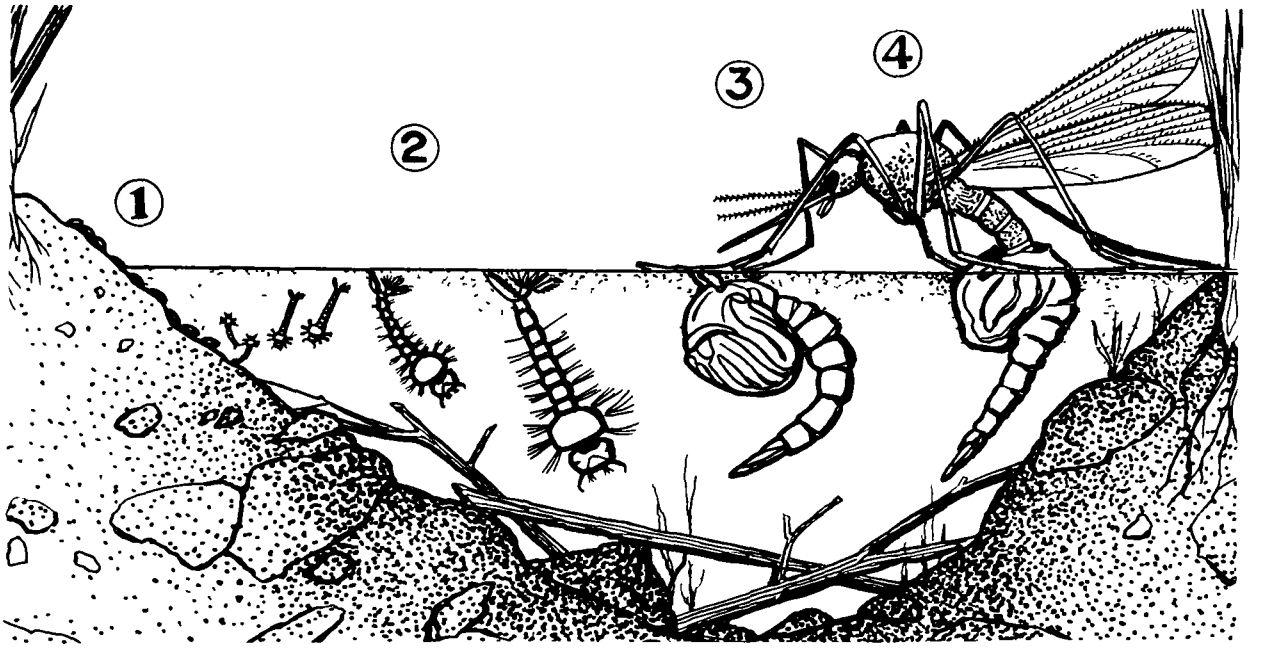

PLATE VIII - Life-stages of an Aedes mosquito: 1, eggs; 2, larvae; 3, pupa; 4, adult emerging from pupal case (author's illustration).

This description is so good that one may feel confidence in identifying the mosquitoes as belonging to the genus Theobaldia. The words "cumbrous gnattes" call to mind large, clumsily flying mosquitoes; and "striving to infixe their feeble stinges" is another way of saying that the insects were rather timid biters. Edwards and James (18) state that Theobaldia annulata Schr., is the largest of British species, and one of the largest biting mosquitoes in the world. The females attack man and domestic animals at dusk. A closely related species T. alaskaensis Ludl., occurs in hilly districts in the north of England and Scotland and is recorded as rather timid in attack.

Fens are low marshy areas in which ideal mosquito breeding places are likely to exist. One might visit such a place in the daytime and not be molested by mosquitoes, but when the sun goes down the shrill piping of myriads of tiny wings is heard, and woe betide the man or beast who lingers there, whether from choice or necessity. Spenser uses this sudden onslaught of mosquitoes on unwary travellers as an illustration in The Faerie Queene (II.9.16), of the fierceness of a surprise attack. In this instance the knights were suddenly assailed by an armed rabble:

"As when a swarme of gnats at eventide
Out of the fennes of Allan doe arise,
Their murmuring small trumpetts sownden wide,
Whiles in the aire their clustring army flies,
That as a cloud doth seeme to dim the skies;
Ne man nor beast may rest or take repast
For their sharpe wounds and noyous injuries,
Till the fierce northerne wind with blustring blast
Doth blow them quite away, and in the ocean cast."

Spenser also wrote a piece called Virgil's Gnat. A shepherd was sleeping on the ground near his flock and was in deadly peril from a serpent approaching him. The gnat woke the shepherd to his danger by biting him on the eyelid, and was inadvertently killed for his pains. Spenser referred to the gnat as a male. Actually only the females attack man and animals. The desire of the female for a meal of blood appears to be a biological urge connected with the proper functioning of the ovaries and egg laying. The mouthparts of the males are too feeble to bite animals, and they feed upon nectar and other plant juices. The latter may also serve as part of the female diet.

Wordsworth had first-hand knowledge of the avidity of blood-hungry female mosquitoes. When mountaineering in the Alps, he and his companion, Robert Jones, were lost on the night of August 21, 1790, in the forest near Lake Como, and were attacked by large numbers of mosquitoes, probably Aedes species. He graphically recorded this experience in The Prelude (VI.712), as follows:

> "... On the rock
> At last we stretched our weary limbs for sleep,
> But could not sleep, tormented by the stings
> Of insects, which, with noise like that of noon,
> Filled all the woods:".

It is a common habit among mosquitoes for the males to fly together in swarms about sunset in a sort of mating dance. This has been specially observed of the domestic

species Culex pipiens L., which is numerous in England. The insects fly up and down and weave in and out in hovering clouds over hedges, trees and buildings, until night falls. While this is going on the females fly into the swarm and emerge each with a mate. It was probably a mating swarm that Keats described in these beautiful lines from the poem To Autumn. The "sallows" referred to are low-growing or shrubby willows.

"While barred clouds bloom the soft-dying day,
And touch the stubble-plains with rosy hue;
Then in a wailfull choir the small gnats mourn
Among the river sallows, borne aloft
Or sinking as the light wind lives or dies;
And full-grown lambs loud bleat from hilly bourn;
Hedge-crickets sing;
The red-breast whistles from a garden croft,
And gathering swallows twitter in the skies."

Kirby and Spence (31, p.59) record that in the year 1736 mosquitoes arose in vast columns like smoke from Salisbury Cathedral, which many people thought was on fire. Again, in August, 1766, incredible numbers appeared at Oxford and were like a cloud darkening the sky. Other authenticated cases of this interesting phenomenon have been recorded. A more usual swarm served Shelley as an appropriate simile in Fragments of an Unfinished Drama:

"Methought I saw
A glassy vapour dancing on the pool,
And on it little quaint and filmy shapes,
With dizzy motion, wheel and rise and fall,
Like clouds of gnats with perfect lineaments."

Even mosquitoes that are not disease-carriers can irritate and annoy sensitive people sufficiently to impair their

health. There is something alarming and persistently sleep-destroying in the high pitched menacing hum of a mosquito in one's bedroom. Perhaps Tennyson had this in mind when writing the lines in Lancelot and Elaine wherein Guinevere urges Lancelot to leave her for the jousts to avoid suspicion of their love, saying:

"The tiny trumpeting gnat can break our dream
When sweetest; and the vermin voices here
May buzz so loud - we scorn them, but they sting."

It is probably not generally realized that Robert Browning's Pied Piper of Hamelin was a mosquito control expert as well as a rat destroyer, but the evidence of this is to be found in the poem. When the Pied Piper entered the Town Hall of Hamelin where the Mayor and Corporation sat considering their rat problem he:

"... advanced to the council table:
And, 'Please your honours', said he, 'I'm able,
By means of a secret charm, to draw
All creatures living beneath the sun,
That creep or swim or fly or run,
And after me so as you never saw:
And I chiefly use my charm
On creatures that do people harm',".

After which he added, and this is the evidence:

"'In tartary I freed the Cham
Last June, from his huge swarm of gnats';".

So, there you have it! How unfortunate for suffering humanity that owing to the cupidity of the Mayor and Corporation of that small German city this remarkable man was lost forever in the heart of a mountain!

Malaria or the Ague

Of the several serious diseases transmitted by mosquitoes only one has ever been well established in the British Isles, but that one is malaria, a paramount scourge of humanity in tropical countries. Nowadays, thanks to modern knowledge and hygiene, drainage of marsh lands, changed living habits, and certain other factors, it is practically non-existent in the United Kingdom, although sporadic cases may appear due to the return of persons, such as soldiers from warmer countries, with the malaria plasmodium in their blood, which may, through their exposure to bites of Anopheles mosquitoes be transmitted to healthy persons.

The disease used to be known in England as ague, and later was called malaria which means literally, "bad air", indicating the popular belief it was caused by the marsh air. It was not until 1897 that Sir Ronald Ross announced his great discovery that malaria is carried solely by the "dapple-winged" mosquitoes of the genus Anopheles, and thus paved the way for the control of this and other insect-borne diseases.

In old "Merrie" England ague was quite common, for even just outside the walls of London the badly drained fields produced great numbers of mosquitoes, some of which would most likely be carriers. Shakespeare in his plays refers to ague at least sixteen times. In I Henry IV (III.1) he makes it obvious that he associated the disease with swampy places.

This was when Hotspur said regarding Bolingbroke's reverses at the hands of Glendower:

> "Home without boots, and in foul weather too!
> How 'scapes he agues, in the devil's name?"

He also knew of its debilitating affects, as shown in Julius Caesar (II.2), where Caesar says to Caius Ligarius:

> "Caesar was never so much your enemy as that
> same ague which hath made you lean."

A third example is to be found in The Tempest (II.2), when Stephano, the drunken butler, sees a four legged monster (formed by Trinculo and Caliban hiding under the latter's cloak), and exclaims:

> "This is some monster of the isle with four legs, who hath got, as I take it, an ague." He gives Caliban a drink from his bottle with the remark, "this will shake your shaking.... If all the wine in my bottle will recover him, I will help his ague.", and later he asks Caliban: "How now, moon-calf? how does thine ague?".

Robert Burns also alludes to malaria in Address to a Toothache, in the lines:

> "When fevers burn, or ague freezes,
> Rheumatics gnaw, or cholic squeezes;
> Our neighbours' sympathy may ease us,
> Wi' pitying moan;".

There were even stranger remedies for malaria than Burn's "pitying moan". Some of these involved the use of spiders. In Elizabeth's time it was believed, at least by some, that a sure cure was to swallow a house-spider alive in treacle. Pepys found that placing a spider in a walnut shell, wrapping it in silk and carrying it thus in one's pocket was beneficial.

Eleazar Albin, in a natural history of spiders published in London in 1736, also declared that one of the house spiders has excellent virtues "in the cure of intermitting fevers, when the bark and other remedies have failed...." The recipe follows:

> "As much of the clean web of the house spider as the weight of two scruples; Mithridate two drams; mix and give it to the patients the night before the fit; let them take after it four ounces of treacle-water, and go to bed and cover themselves warm, endeavouring to sweat. They will have a most severe fit after the taking the first dose, but after the second dose it will leave them. By this method I have cured many people of stubborn and long continu'd tertian, quartan, and quotidian Fevers.... I have likewise cured several children, both male and female, by hanging a large spider confined alive in a box about their neck, reaching to the pit of the stomach, without giving any internal remedies."

Fantastic, but hardly effective against an organism which destroys hundreds of thousands of human lives annually!

In times past ague was prevalent among the people who lived in or near the fenlands. Perhaps James Thomson had the fens in mind when he wrote the following in The Seasons: Summer:

> "When o'er this world, by equinoctial rains
> Flooded immense, looks out the joyless sun,
> And draws the copious stream: from swampy fens,
> Where putrefaction into life ferments,
> And breathes destructive myriads; or from woods,
> Impenetrable shades, recesses foul,
> In vapours rank and blue corruption wrapt,
> Whose gloomy horrors yet no desperate foot
> Has ever dared to pierce; then, wasteful, forth
> Walks the dire Power of pestilent disease."

In the seventeenth century the English fens consisted of nearly three-quarters of a million acres of morass studded at wide intervals with islands of firm land where, according to

Finnemore (22), "lived the Fenmen, an ague-stricken race, gaining their living by fishing and fowling". Since then this district has been thoroughly dyked and drained and now constitutes a fertile and valuable area of agricultural land free from the scourge of mosquito-borne disease.

Family Chironomidae: The Midges.

The midges have a close superficial resemblance to mosquitoes, but may be readily distinguished from them by the absence of scales on their wings. They are a numerous family but do not appear to have figured much in poetry and drama. The larvae develop in water-bodies of various kinds, and the adult midges may often be seen towards sunset dancing in the air in swarms during which pairing of the sexes takes place. Such an occasion was observed by Owen Meredith (Bulwer Lytton) and recorded in these lines:

> "Meanwhile, there is dancing in yonder green bower
> A swarm of young midges. They dance high and low;
> 'Tis a sweet little species that lives but one hour,
> And the eldest was born half an hour ago."

It is rather difficult to separate the poetical allusions to midges from those concerning other insects of similar habits, but it seems likely that Wordsworth was also describing mating swarms of midges in the following lines from The Excursion:

"Creatures that in communities exist
Less, as might seem, for general guardianship
Or through dependence upon mutual aid,
Than by participation of delight,
And a strict love of fellowship combined.
What other spirit can it be that prompts
The gilded summer flies to mix and weave
Their sports together in the solar beam,
Or in the gloom and twilight hum their joy?"

Another allusion is found in Coventry Patmore's The Cry at Midnight, wherein it is stated that:

"The midge's wing beats to and fro
A thousand times ere one can utter 'O'."

This is doubtless poetic licence, but the wing beat is unquestionably rapid, and produces the tiny shrill piping characteristic of these insects in flight.

Family Tabanidae: The Horse Flies.

The flies in this family are the rather large, somewhat flattened, robust insects, which are often seen on warm, sunny days attacking horses, cattle, other animals, and not infrequently, man. Their eyes are large and iridescent in life, revealing brilliant shades of colouring. The mouth-parts are in the form of a piercing proboscis: the females are avid blood-suckers, but the males live on nectar and other plant juices.

Horse flies are swift and powerful fliers and animals sometimes run away in fear of them. Catlow (10, p.305) suggests that a horse fly was meant in Isaiah (VII) in the words:

"The Lord shall hiss for the fly that is in the uttermost part of the rivers of Egypt.",

and states that Virgil described this insect under the name of Asilus, as follows:

> "Of winged insects mightly swarms are seen;
> This flying plague (to mark its quality)
> Oestros the Grecians call - Asilus we:
> A fierce, loud buzzing breeze. Their stings draw blood,
> And drive the cattle gadding through the wood."

Others, however, have thought that the fly mentioned in Isaiah is the tsetse fly, which belongs to a different family and is the carrier of the dreaded African sleeping sickness of humans and nagana of horses.

Perhaps it was a tabanid that attacked Chaucer's noble and patient lion, in The Legend of Good Women:

> "For lo, the gentil kind of the lioun!
> For whan a flye offendeth him or byteth,
> He with his tayl awey the flye smyteth,
> Al esily; for, of his gentrye,
> Him deyneth nat to wreke him on a flye,
> As doth a curre or elles another beste."

Tabanid flies are especially troublesome in the vicinity of ponds, streams and marshy places, along the margins of which their larvae develop in damp soil or mud and are predacious on small animal life such as earthworms and the larvae of insects. The females lay their eggs in compact masses on the leaves of aquatic and other plants overhanging the water, and the larvae on hatching fall in and find their way to the favoured habitat. When full-grown they move to drier ground before pupating.

Keats had trouble with biting flies which were evidently tabanids, while on a visit to a place near Glasgow.

He wrote a rather humourous rhyme on this incident in a letter to his brother Thomas, dated July 17, 1818, of which the following is an extract:

> "I have just been bathing in Loch Fyne a salt water lake opposite the Windows, - quite pat and fresh but for the cursed Gad flies - damn 'em they have been at me ever since I left the swan and two necks."

This statement was followed by a ballad of 14 stanzas on the gadfly of which the following are representative:

"The Gadfly he hath stung me sore -
O may he ne'er sting you!
But we have many a horrid bore
He may sting black and blue.

. . . . .

"Has any here an old grey mare
With three legs all her store,
O put it to her buttocks bare
And straight she'll run on four.

. . . . .

"Is there a Man in Parliament
Dumb-founder'd in his speech,
O let his neighbour make a rent
And put one in his breech."

Imms (30, p.635) states that Haematopota pluvialis is the most abundant of English tabanids and the one most troublesome to man.

Family Oestridae: The Warble and Bot Flies.

The warble and bot flies are robust, somewhat hairy insects, rather like bees in appearance. They are important to agriculture because two species of the former spend their larval stages as internal parasites of cattle, and three species of bots develop in a similar manner in horses. The

eggs are attached to the hairs of the animals. In the case of the bots, the hatching larvae are swallowed and fasten themselves to the stomach-wall, and when mature leave the animal through the anus. In the case of the warbles, they penetrate the skin and, after migrating for several months through the body, finally come to rest under the skin of the back, which they perforate for breathing and to provide an exit when their development is completed. This may be an over simplification of their complex life-histories, but it will serve to give an indication of the nature of these troublesome and injurious insects.

Shakespeare seems to be the only one among the English poets and dramatists to mention them. An old English name for the warble fly was "brize" or "breese" fly. In Troilus and Cressida (I.3) appears the remark by the Grecian leader Nestor, that:

> "The herd hath more annoyance by the breese
> Than by the tiger."

This is an allusion to the great terror shown by cattle when warble flies, especially the larger form, Hypoderma bovis DeG., are flying at them to oviposit. Another reference to this phenomenon is to be found in Antony and Cleopatra (III.8), when Scarus describes to Enobarbus the flight of Cleopatra's ships at the battle of Actium:

> "Yon ribaudred nag of Egypt,--
> Whom leprosy o'ertake!--i' the midst o' the fight,
> When vantage like a pair of twins appear'd
> Both as the same, or rather ours the elder,
> The breese upon her, like a cow in June,
> Hoists sail, and flies."

Perhaps it was also a warble fly that Ben Jonson referred to in The Poetaster (III.1):

"Gods, you do know it, I can hold no longer,
This brize has pricked my patience."

The presence of large numbers of bots in the stomach of a horse may result in the animal suffering from general debility. In Shakespeare's time the origin of the bots was not properly understood, and perhaps poor food was considered a contributory cause to infestation. In any event, the carrier in I Henry IV (II.1), in the inn yard at Rochester, said to the other carrier when attending to their horses, that:

"Peas and beans are as dank here as a dog,
and that is the next way to give poor jades
the bots:".

Another reference to bots occurs in The Taming of the Shrew (III.2), when the servant Biondello says of Petruchio's horse it is "stark spoiled with the staggers, begnawn with the bots".

Family Drosophilidae: The Fruit Flies.

"'Tis eminence makes envy rise,
As fairest fruits attract the flies."

To Delaney: Swift.

These are the small reddish-brown flies often seen flying rather aimlessly about ripe or decaying fruit and fermenting materials, and suddenly alighting thereon to feed or lay their eggs. Milton wrote of them in Paradise Regained (IV.15):

"Or as a swarm of flies at vintage time,
About the wine press where sweet must is poured,
Beat off, returns with humming sound;".

Anyone who has made grape wine in the autumn will have had trouble controlling these pests, and in preventing them from drowning themselves in the wine. Among the good advice proferred by Tennyson's Ancient Sage is this admonition to avoid excessive eating and drinking:

"Nor roll thy viands on a luscious tongue,
Nor drown thyself with flies in honeyed wine:".

Tennyson may have had house flies in mind, but the fruit flies, too, often are found floating, dead, in wine.

Family Cordyluridae: The Dung Flies.

One genus of this family: namely, Scatophaga, consists of slender flies clothed with yellowish hair. These are called dung flies because of their habit of frequenting and breeding in fresh cow dung. Evidently George Herbert had observed them for, in The Church Porch, he remarked on the similarity of their colour to cow manure, in order to point a moral:

"Make not thy sport abuses; for the fly
That feeds on dung is coloured thereby."

Another allusion is in Lyly's Euphues (p.240) where reference is made to "the fly that shunneth the rose tô light on a cow-shard".

CHAPTER X

Order Siphonaptera: The Fleas and Flea-borne Plague

The common bloodsucking ectoparasites of mammals and birds, known as fleas, are widespread throughout the world, and abundant both in species and in numbers, so it is not surprising that they have forced themselves on the attention of many writers, and have found their way into a variety of poems and dramatic works.

Coleridge has put the matter nicely in the following lines:

> "A poet's song can memorize a flea;
> The subtle fancy of deep-witted Donne
> The wee phlebotomist descanted on...
> Pasquier, the gravest joker of the age,
> Berhymed La Puce in many a polished page."

According to Essig (20) the word "flea" was derived from the Middle English fle, fleē; the Anglo-Saxon flea, fleah; the Danish vloo; German floh, all descriptive of the insect's ability to flee or run away. This elusiveness is made possible by the small size, the hard, smooth, laterally compressed body, and the long powerful legs fitted for leaping.

The eggs of fleas are laid on the bodies of their hosts, from which they readily fall to the floor and hatch into tiny larvae. These whitish, active grubs, which measure hardly more than one-sixth of an inch when full-grown, feed on

organic matter in floor cracks and similar places. On reaching maturity the larvae spin cocoons in which transformation to the adult form takes place, and from which after varying periods the hungry fleas emerge. It will be seen from this brief outline that fleas are most likely to be abundant where there is a lack of cleanliness. Because of this, fleas were a much greater problem in temperate countries such as England before cleanliness became popular and efficient sanitary measures were developed than they are today.

Fleas probably have always been very prevalent in the Middle East, but they appear to be mentioned only twice in the Bible indicating, perhaps, that the patient Hebrews were too accustomed to their obnoxious presence to think them worthy of note in their writings. The insignificance and ellusiveness of the flea is stressed in these references. David says, referring to Saul:

> "After whom is the king of Israel come out? After whom dost thou pursue? After a dead dog, after a flea?" (Samuel, 24:20), and again: "Now therefore, let not my blood fall to the earth before the face of the Lord; for the king of Israel is come out to seek a flea, as when one doth hunt a partridge in the mountains" (Samuel, 26:20).

Undoubtedly, Chaucer was familiar with these tiny but formidable pests in the England of the fourteenth century, as is revealed by the following extract from The Maunciple's Tale:

> "'Awake thou cook,' quod he, 'god yeve thee sorwe,
> What eyleth thee to slepe by the morwe?
> Hastow had fleen al night, or artow dronke,
> Or hastow with some quene al night y-swonke,
> So that thou mayst nat holden up thyn heed?'"

In the century which followed, John Skelton indicated clearly in his poem Phyllype Sparowe, that fleas not only were common but were taken as a matter of course by people generally. Philip, the sparrow referred to in the poem, belonged to the fair Jane Scroupe:

"For it wolde come and go
And fly so to and fro
And on me it wolde lepe
When I was aslepe
And his fethers shake
Wherewith he wolde make
Me often for to wake
And for to take him in
Upon my naked skyn;

"Phillyp wolde seke and take
All the flees blake
That he coulde there espye
With his wanton eye."

Fleas were also common in Elizabethan England and were mentioned both by Marlowe and Shakespeare in their plays. For instance, in Marlowe's Doctor Faustus (Scene 4), when Wagner, servant to Faustus, promised the Clown that if he would serve Faustus he would teach him to turn himself into a dog, cat, mouse, rat, or anything, the Clown replied:

> "If you turn me into anything, let it be in the likeness of a little pretty frisking flea, that I may be here and there and everywhere. Oh, I'll tickle the pretty wenches' plackets; I'll be amongst them i' faith."

In Shakespeare's Merry Wives (IV.2), when Mistress Ford's jealous husband was searching the laundry basket for a man, she, knowing none was there, said boldly: "If you find a man there, he shall die a flea's death", meaning, no doubt,

that he would be crushed as completely as a flea between the thumb nails. Angry Petruchio, in The Taming of the Shrew (IV.3), had the annoying qualities of the flea in mind when he called the impudent tailor, "Thou flea, thou nit, thou winter-cricket thou!"

In Twelfth Night (III.2), Sir Toby Belch graphically indicates the cowardly nature of Sir Andrew Aguecheek by remarking to the servant Fabian, that if Sir Andrew:

> "were opened, and you find so much blood in his liver as will clog the foot of a flea, I'll eat the rest of the anatomy."

The inn at Rochester referred to in Part I of King Henry IV (II.1) must have been flea-ridden indeed, to warrant this description by the two carriers:

> Sec. Car. "I think this be the most villainous house in all London road for fleas: I am stung like a tench."
> First Car. "Like a tench! By the mass, there is ne'er a king in Christendom could be better bit than I have been since the first cock."
> Sec. Car. "Why, they will allow us ne'er a jordan, and then we leak in your chimney; and your chamberlie breeds fleas like a loach."

In these words put into the mouths of his characters, Shakespeare indicates the widespread abundance of fleas, even royalty being afflicted, and associates their occurrence with the presence of filth. In explanation it should be pointed out that a "jordan" is a chamber pot, "chamberlie" is urine, and a "loach" is a small species of fish.

There are two other references in Shakespeare's

plays which illustrate that fleas were a common and familiar affliction in his day. In King Henry V (II.3), the boy, speaking of Falstaff, says: "Do you not remember, 'a saw a flea stick upon Bardolph's nose, and 'a said it was a black soul burning in hell-fire?" Evidently, Bardolph's nose had the red glow of a heavy drinker. In the same play (III.7), the Duke of Orleans, in reply to a remark by Lord Rambures that "That island of England breeds very valiant creatures", says: "You may as well say, that's a valiant flea that dare eat his breakfast on the lip of a lion." In other words, the invading English had not the wit to understand the danger they were incurring.

Donne, a contemporary of Shakespeare, wrote a poem to "The Flea". The flea bit a man and a woman, following which the latter killed the flea. Then said he to her:

> "Yet thou triumph'st, and say'st that thou
> Find'st not thyself nor me the weaker now.
> 'Tis true; then learn how false fears be;
> Just so much honour, when thou yield'st to me,
> Will waste, as this flea's death took life from thee."

In Donne's time, the deadly role of the flea as the carrier of bubonic plague was quite unsuspected, as shown in the statement in the twelfth stanza of his poem Devotions, that "The flea, though he kill none, he does all the harm he can". Actually, the flea was looked upon merely as a rather troublesome pest. To say with Fletcher (Love's Cure, Act III, Sc.3) that a person "went away with a flea in his ear" means only that he went away annoyed.

In his satirical poem Hudibras, Butler endowed one of his characters with the knowledge of:

> "How many scores a flea will jump,
> Of his own length, from head to rump,
> Which Socrates and Chaerophon
> In vain assayed so long agone;
> Whether his snout a perfect nose is
> And not an elephant's proboscis."

In the seventeenth century, when Butler wrote this, experimental entomology was hardly thought of, so it is unlikely that anyone really knew how far a flea could jump. In more recent times the matter has been investigated, and Mitzmain (39) reports that the human flea's jump may reach horizontally thirteen inches and vertically to a height of almost eight inches. A large flea would measure about one-eighth of an inch, so a forward leap of thirteen inches would carry it a distance exceeding 100 times its own length, a prodigious jump indeed!

Up to the early seventeenth century microscopes were of primitive and simple construction and magnified objects only about ten times. This was enough, however, to excite popular interest in tiny living things. According to Nordenskiöld (42) it was considered especially fascinating at that time thus to observe fleas, with the result that the earliest type of microscope received the name of vitrum pulicare, or flea glass.

Nearly everyone has read or heard, in one form or

another, the idea expressed in these lines from Jonathan Swift's Rhapsody:

> "So, naturalists observe, a flea
> Has smaller fleas that on him prey;
> And these have smaller still to bite 'em;
> And so proceed ad infinitum."

Thus succinctly is expressed a profound truth which is the basis of modern efforts to establish the biological control of many important insect pests. The "smaller fleas that on him prey", however, may not always be beneficial from the human point of view, as they sometimes assume the form of malignant microorganisms that may be conveyed to man. The bacteria known as Pasteurella pestis, which cause the infamous bubonic plague or "Black Death" are transmitted to humans by fleas.

The true nature of the plague or Black Death has been known for less than half a century. The causative organism was first isolated in 1894, and in 1906-7 its dissemination by fleas was fully demonstrated in India by the British Plague Commission. Little did the millions of unfortunate victims of the disease during past centuries suspect the vermin by which they were surrounded. Actually, it is primarily a disease of rodents. The fleas which feed on them become infected and when their host dies they leave it and attack other animals, including man, who in turn contracts the disease.

Wells, in "The Outline of History" gives a brief

summary of the more important outbreaks of plague in the world and the great effect they had on social conditions. These outbreaks occurred intermittently throughout the centuries down to quite recent times, and the danger still persists. Between the year 164 and 180 A.D. a great plague swept through the Roman Empire of Marcus Aurelius, and also through China, slaying millions and disorganizing society. Wells states that pestilences were recorded in England by Bede in 664, 672, 678, and 683; four outbreaks in twenty years! The most violent visitation, however, occurred about the middle of the fourteenth century, and was appropriately named the Black Death. It swept over a large part of Europe, Asia and Africa, and in a period when populations were very much smaller than they are today, brought death to an estimated twenty-five million people in Europe, and thirteen million in China.

A vivid eye-witness description of the ravages of the plague in Florence in 1348 was written by Boccacio. This same year the pestilence reached England. General living conditions in the England of the Middle Ages were ideal for spreading the plague. Finnemore (22) states of the period: "Houses were very dirty; the surroundings filthy. The dunghill stood near the door. The houses of the poorer classes were mere huts.... The floor was of hard-trodden earth...." And one may add that people were generally careless in disposing of animal matter and garbage, so that rats were abundant, and everybody kept

dogs which were full of fleas, and the people themselves in their dirty surroundings were thoroughly flea-bitten. So the fleas carried the plague from rat to rat and from rats to humans, and the Black Death swept like a devastating fire through the land and is reported to have destroyed nearly one-half of the four million inhabitants. Large tracts of country-side were denuded of their populations; many villages were left deserted and silent, and life in the towns and cities was dreadfully depleted and thoroughly disorganized; two-thirds of the students at Oxford are said to have died. The immediate result of this devastation was a great shortage of labour, and the inception or acceleration of social changes. The free workers demanded and received higher wages and moved about from one locality to another to better their lot. Many serfs obtained their freedom by fleeing to the towns where after being concealed for a year and a day they became freemen under the law. On the other hand it was the labour shortage which brought about the imposition of unjust laws which in turn led to the Peasants' Revolt under Wat Tyler in 1381.

In the words of Finnemore:

> "Thus, within half a century after the Black Death the serfs were freed from their bondage to the land, the labourer had asserted his right to a fair day's wage for a fair day's work, the tenant farmer had made his appearance, and the whole constitution of English society had changed. The fourteenth century is one of the most striking in our history. It saw the great French wars; it saw Crecy and Poitiers; but assuredly it saw nothing more important or more far-reaching in its effects than the Black Death."

Intermittent outbreaks of plague occurred in England from the fourteenth to the end of the seventeenth century. It was an ever present and terrifying menace. Naturally there are numerous references to it in the works of the poets, who lived during those centuries. Chaucer, who was a boy at the time of the 1348 outbreak, mentions the pestilence at least fourteen times. The following lines from the Pardoner's Tale almost certainly relate to the Black Death:

> "'Ther com a prive thef, men clepen Deth,
> That in this contre al the peple sleth;
> And with his spere he smot his hert a-tuo,
> And went his way withoute wordes mo.
> He hath a thousand slayn this pestilence.'
>
> "'By seinte Mary!' sayde this taverner,
> 'The child saith soth; for he hath slayn this yeer,
> Hens over a myle, withinne a gret village,
> Bothe man and womman, child, and hyne, and page;
> I trowe his habitacioun be there.'"

Spenser, in the Faerie Queene (Bk.3, C.3) speaks of "plagues and murrins pestilent" which consume Britons, forming "huge hills of dying people.... till all their warlike puissance" is spent. Further, in Prosopopoia (7-12) he states that the "hot Syrian Dog...

> Corrupted had th' ayre with his noysome breath
> And powr'd on th' earth plague, pestilence, and death.
> Emongst th' rest a wicked maladie
> Raign'd emongst men, that manie did to die,
> Depriv'd of sense and ordinarie reason;
> That it to leaches seemed strange and geason."

According to Bartlett's Concordance there are 94 references to "plague" and 13 to "pestilence" in the works of

Shakespeare. The former word is most frequently used in the sense of "A plague upon him (he or it, etc.)!", "A plague upon such backing!", "The very devils cannot plague them better", "A plague of sighing and grief!", etc. However, several refer directly to the disease, of which the following are examples:

King Henry, in Henry V (IV.3.101), when asked to surrender to the French by the Constable of France, refused, and sent word to the latter, that even those of his soldiers who were slain in battle and buried in French soil would:

> "be famed; for there the sun shall greet them, and draw their honours reeking up to heaven; leaving their earthly parts to choke your clime, the smell whereof shall breed a plague in France. Mark then abounding valour in our English; that being dead, like to bullet's grazing, break out into a second course of mischief, killing in relapse of mortality."

Thus Shakespeare expressed a popular belief that plague was caused by exhalations from decaying organic matter, with no thought of the fleas. The mysterious nature of the spread of infection is also indicated in Twelfth Night (I.5.314), when Olivia says:

> "How now! Even so quickly may one catch the plague? Methinks I feel this youth's perfections with an invisible and subtle stealth to creep in at mine eyes."

The horrid bubos characteristic of bubonic plague are referred to in this line from Lear (II.4.227):

> "Thou art a boil, a plague-sore, an embossed carbuncle, in my corrupted blood."

There are several other equally significant passages in Shakespeare's works, but these will suffice.

The impartial manner in which the plague struck down rich and poor alike is indicated in the following stanza from a poem by Thomas Nashe, a contemporary of Shakespeare, entitled In Time of Pestilence. Each verse ends in a pitiful cry to God for mercy:

"Rich men, trust not in wealth,
Gold cannot buy you health,
Physic himself must fade;
All things to end are made;
The plague full swift goes by;
I am sick, I must die --
Lord, have mercy on us!"

Watrous* records that the Elizabethan poet and dramatist John Fletcher died of the plague in August, 1625, and to this effect quotes Aubrey's Brief Lives:

> "Mr. John Fletcher, poet: in the great plague, 1625, a knight of Norfolk (or Suffolke) invited him into the countrey. He stayed but to make himself a suit of cloathes, and while it was makeing, fell sick of the plague and dyed."

Nearly everybody has some knowledge of the Great Plague which visited London in 1665. This outbreak, which is believed to be the twelfth that had afflicted the City, was less severe than the Black Death of 1348, but is better and more widely known because of the vivid accounts of its ravages which were written by talented writers of the seventeenth century. Such accounts may be found in Daniel Defoe's "Journal of the Plague Year", and in Ainsworth's "Old St. Pauls".

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*Watrous, G.A. "Elizabethan Dramatists", New York: T.Y. Crowell & Co., 293 pages, 1903.

Defoe and John Bunyan, although neither died from the plague, were interred in one of the chief burial grounds for London plague victims. This is Bunhill Fields, the name of which, according to Curtis (14), was originally, and sinisterly, Bone Hill Fields.

Among contemporary poets, James Thomson (1700-1748) has, perhaps, given the most graphic description of the Great Plague in his poem The Seasons - Summer. His indication of the origins of the contagion doubtless reflected popular beliefs:

"What need I mention those inclement skies,
Where, frequent o'er the sickening city, Plague,
The fiercest child of Nemesis divine,
Descends? from Ethiopia's poison'd woods,
From stifled Cairo's filth, and fetid fields
With locust-armies putrefying heap'd,
This great destroyer sprung! Her awful rage
The brutes escape: Man is her destined prey;
Intemperate Man! and o'er his guilty domes,
She draws a close incumbent cloud of death;
Uninterrupted by the living winds,
Forbid to blow a wholesome breeze; and stain'd
With many a mixture by the sun, suffused,
Of angry aspect. Princely wisdom, then,
Dejects his watchful eye; and from the hand
Of feeble justice, ineffectual, drop
The sword and balance; mute the voice of joy,
And hush'd the clamour of the busy world.

"Empty the streets, with uncouth verdure clad;
Into the worst of deserts sudden turn'd
The cheerful haunt of Men; unless escaped
From the doom'd house, where matchless horror reigns,
Shut up by barbarous fear, the smitten wretch,
With frenzy wild, breaks loose; and, loud to Heaven
Screaming, the dreadful policy arraigns,
Inhuman and unwise. The sullen door,
Yet uninfected, on its cautious hinge
Fearing to turn, abhors society:
Dependents, friends, relations, Love himself,
Savaged by woe, forget the tender tie,
The sweet engagement of the feeling heart.

"But vain their selfish care: the circling sky,
The wide-enlivening air is full of fate;
And, struck by turns, in solitary pangs
They fall, unblest, untended, and unmourn'd.
Thus o'er the prostrate city black Despair
Extends her raven wing."

Byron's genius, too, has caught the exceeding horror of the plague in these few lines in Manfred (II.3.718):

"The city lies sleeping;
The morn, to deplore it,
May dawn on it weeping:
Sullenly, slowly,
The black plague flew o'er it--
Thousands lie lowly;
Tens of thousands shall perish;
The living shall fly from
The sick they should cherish;
But nothing can vanquish
The touch that they die from."

The imaginative Shelley also wrote of it with telling effect; for instance, in these words from Hellas:

"At the third watch the Spirit of the Plague was heard abroad flapping among the tents; those who relieved watch found sentinels dead",

and, in Peter Bell the Third (III.21),

"... in a town plague-stricken, each man, be he sound or no, must indifferently sicken".

England has been free of plague for many years and reference to it by modern English poets is rare. However, sporadic outbreaks still occur from time to time in various parts of the world. The chief endemic centres at the present time are in Asia, India and China, where it still causes high mortality, ten million deaths from plague having been recorded in India alone in a period of twenty years. In Europe, thanks

largely to improved sanitary conditions and the application of modern knowledge, it has apparently largely disappeared, although under stress of war conditions a recrudescence might occur. An important source of danger in commerce is ship-borne infected rats. To lessen this danger, authorities have passed legislation requiring ships to be fumigated periodically to destroy the rats, and rat guards are required on all ships while in port. It is of interest to note that plague has been established in the United States since 1900, when it appeared for the first time in San Francisco, California. Since then, about 500 cases have been reported in the western and southern states (up to 1941), and the disease now occurs widely in that region in wild rodents, which serve as a reservoir from which domestic rats and man may become infected.

To return to the carriers of the plague, it should be mentioned that in the British Isles there are nearly fifty species of fleas, of which several commonly attack man. The species which the poets and dramatists usually have in mind is most likely the human flea, Pulex irritans L., which prefers man to other mammals. It is certainly the species referred to by Thomas Hood in his poem The Cannibal Flea, of which the following is a sample:

"It was many and many a year ago,
In a district styled E.C.,
That a monster dwelt that I came to know
By the name of the Cannibal Flea
And the brute was possessed of no other thought
Than to live--and to live on me."

Also, it is doubtless the species met with in a Spanish inn by Hilaire Belloe, and commemorated in his poem Tarantella:

"Do you remember an Inn, Miranda?
Do you remember an Inn?
And the tedding and the spreading
Of the straw for a bedding,
And the fleas that tease in the High Pyrenees,
And the wine that tasted of the tar?"

The cat and dog fleas, Ctenocephalides felis Curtis and C. canis Bouche, also attack man readily when hungry and separated from their normal hosts. These and the human flea are all capable of transmitting plague, and are also the intermediate hosts of the dog tapeworm, which is sometimes found in children who have been unfortunate enough to swallow an infected flea.

Dogs have always been notorious for the fleas they carry, and sometimes through neglect they become heavily infested. In Jacula Prudentum, Herbert, a contemporary of Shakespeare, remarks that "He that lies with the dogs, riseth with fleas", which is at least a statement of probability. Thomas Hobbes, in Odyssey, spoke of "the old dog Argos, full of fleas". Two-hundred years later, Andrew Lang, referred to the same dog in stanza 3, of The Friend of Man, as follows:

"We meet him first in Homer's verse,
The dog by the Aegean seas;
He barks at strangers, ay, and worse,
He bites! We learn in language terse,
That even Argos has the curse of fleas!"

The question of controlling fleas has been a live one for ages, but it is probably only in recent years that the subject has been properly understood. Thomas Tusser, who wrote advice to farmers and their wives in the latter part of the sixteenth century, had the following to offer as a remedy against these blood-thirsty little pests:

> "While wormwood hath seed, get a handfull or twaine,
> To save against March, to make flea to refraine,
> Where chamber is sweeped and wormwood is strown,
> No flea for his life dare abide to be known."

The most satisfactory part of this advice is the sweeping, for scrupulous cleanliness is the best safeguard against flea infestations. Failing this, modern insecticides are very effective.

CHAPTER XI

The Lesser Insect Orders: The Earwigs, Mayflies, Dragon-flies and Damsel-flies.

Order Dermaptera: The Earwigs.

The scientific name of this order is of Greek origin and means "skin-wings", referring to the skin-like or leathery character of the very short front wings or tegmina. The hind wings are membranous, circular or somewhat ear-shaped and, when not in use, are folded beneath the fore wings. Earwigs are elongate insects, and are characterized by a conspicuous pair of horny forceps borne at the end of the body. When the insect is alarmed or disturbed it raises the tip of the abdomen and opens the forceps in a threatening manner.

Most of the poets seem to have ignored the earwig, although it is very common in England, especially the species Forficula auricularia L., which is a pest in gardens and sometimes invades houses, and, in recent years, has established itself in Canada and the United States. Perhaps the earwig's nocturnal habits are partly responsible for it being overlooked. However, the Elizabethan, Michael Drayton, in The Court of Fairy, introduced the earwig as the steed of the fairy knight-errant Pigwiggen. The latter was armed with a cockle-shell for shield, and a hornet's sting for rapier, and before starting off in quest of adventure:

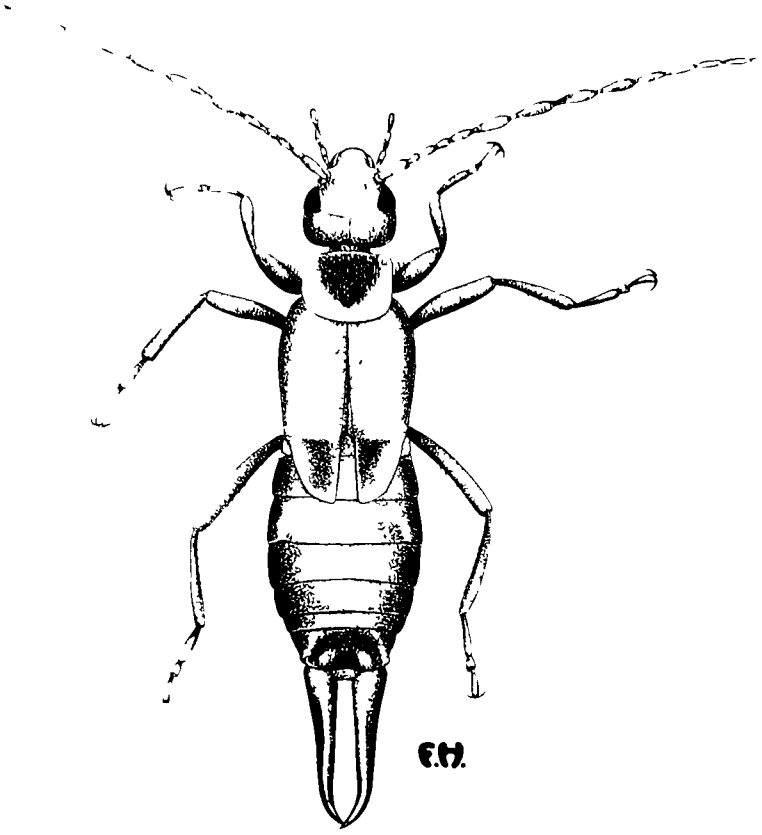
"Himself he on an earwig set,
Yet scarce he on his back could get,
So oft and high he did curvet
Ere he himself did settle:
He made him turn, and stop, and bound,
To gallop and to trot the round,
He scarce could stand on any ground,
He was so full of mettle."

Apparently the earwigs were well-known to the fairies for, according to the poets, they used them for food as well as for transport. In Robert Herrick's Hesperides there is a description of King Oberon's feast attended by his queen Titania and "all the fairy elves that be". Among the delicacies served were:

"Beards of mice, a newt's stew'd thigh,
A bloated earwig and a fly:".

The female earwig is remarkable in that she carefully guards her eggs, and watches over the young that hatch from them until they are able to take care of themselves. This maternal solicitude is hinted at in Thomas Hood's, The Haunted House, in the line reading: "The key-hole lodged the ear-wig and her brood." The eggs of earwigs are usually laid in damp places and, according to observers in several different parts of the world, the mother licks them carefully each day to protect them from mildew.

It is possible that under certain circumstances the earwig might endeavour to find shelter in the human ear. In any event, it is an old and popular belief that it does so, and this may be the origin of its common name. Hood refers to



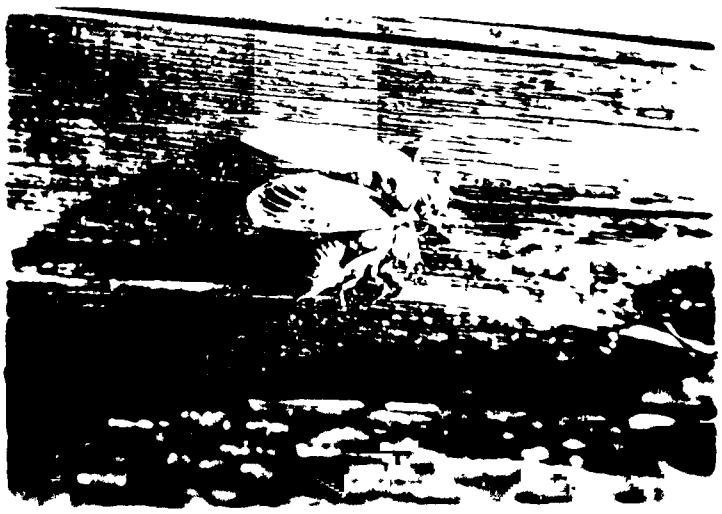


PLATE IX - Above: the European earwig, much enlarged (after Gibson). Below: cicada emerging from pupa, slightly reduced.

this belief in the following stanza from Love Lane:

"'Tis vain to talk of hopes and fears
And hope the least reply to win,
From any maid that stops her ears
In dread of ear-wigs creeping in!"

In certain parts of rural England the earwig is called by the odd-sounding name of "battle-twig". This appears in Tennyson's The Spinster's Sweet-Arts, in the lines wherein the spinster praised Steevie's clean cultivation:

"An' thy farmin' es cleän es thysen', fur Steevie,
tha kep' it sa neät
That I niver not spied sa much es a poppy
along wi' the wheät,
An the wool of a thistle a-flyin' an' seeädin'
tha haäted to see;
'Twur es bad es a battle-twig 'ere i' my ön
blue chaumber to me."

Order Ephemeroptera: The Mayflies.

"The life of all creatures is brave and pitiful
Whether they be men, with dark thoughts to vex them,
Or birds, wheeling in the swift joys of flight,
Or brittle ephemerids, spinning to death in the haze
Of gold that quivers on dim evening waters."

The Quails: Francis Brett Young.

Mayflies, known by some as ephemerids, are delicate four-winged insects with soft elongate bodies furnished at the hind extremity with either two or three long, slender, tail-like appendages. They occur most abundantly, sometimes in immense numbers, in the vicinity of natural water bodies, such as lakes, rivers and streams; where, because they are attracted to lights at night, they frequently become a nuisance

to motorists and to occupants of unscreened buildings, and about street lamps. Although at least forty species of mayflies occur in the British Isles, the poets made few allusions that could be definitely associated with this order. Perhaps Pope had in mind a dancing cloud of these insects, glistening in the light of the setting sun, when he wrote the following beautiful lines in The Rape of the Lock (Canto II):

"Some to the sun their insect wings unfold,
Waft on the breeze, or sink in clouds of gold,
Transparent forms, too fine for mortal sight,
Their fluid bodies half dissolved in light.
Loose to the wind their airy garments flew,
Thin glitt'ring textures of the filmy dew,
Dipped in the richest tincture of the skies,
Where light disports in ever-mingling dyes,
While ev'ry beam new transient colours flings,
Colours that change whene'er they wave their wings."

As the Greek name of the order indicates, mayflies have only a brief aerial life lasting from a few hours to a few days. They cannot live longer, for their mouthparts are vestigial and incapable of feeding. Lacy, the Earl of Lincoln, in Robert Greene's play Friar Bacon and Friar Bungay (Sc.10, L.124), wrote to his Margaret to test her constancy, telling her that loves, like:

"the flies haemerae, fair Peggy, take
life with the sun, and die with the dew;".

However, the mayfly young, called nymphs, live as long as three years in the water before crawling out to give rise to the winged males and females. The sole function of the latter,

before death quickly overtakes them is to mate and drop their eggs in the water to carry on the species. In Wordsworth's poem To Sleep, the fly mentioned may have been an egg-laying mayfly:

"A fly that up and down himself doth shove
Upon a fretful rivulet, now above,
Now on the water vexed with mockery."

Doubtless Shelley was also thinking of the ephemeral mayfly when he wrote in Adonais:

"The sun comes forth, and many reptiles spawn;
He sets and each ephemeral insect then
Is gathered into death without a dawn."

His sympathy for the mayfly's short honeymoon existence and sudden tragic end is expressed in The Witch of Atlas:

"What hand would crush the silken-winged fly,
The youngest of inconstant April's minions,
Because it cannot climb the purest sky,
Where the swan sings, amid the sun's dominions?
Not thine. Thou knowest 'tis its doom to die,
When Day shall hide within her twilight pinions."

Like most other insects, the mayflies have numerous enemies in nature. Fish are very fond of them and, indeed, they form an important item of fish diet. Predacious insects and birds also gorge on them during their season of winged abundance. The seemingly cruel manifestations of the struggle for existence, the workings of biological control, are referred to somewhat bitterly by that great observer and nature lover Tennyson, in his poem Maud (IV.4):

"For nature is one with rapine, a harm no preacher can heal;
The mayfly is torn by the swallow, the sparrow spear'd by the shrike,
And the whole little wood where I sit is a world of plunder and prey".

Order Odonata: The Dragon-flies and Damsel-flies.

Everyone who lives in or visits the countryside during the pleasant summer months is familiar with the rather large, slender and often brightly coloured dragon-flies and damsel-flies which comprise the order Odonata. They are four-winged insects, the wings being strong and densely criss-crossed with very fine veins. The position of the wings when the insects are at rest enables one to readily distinguish between them. The dragon-flies, which are more robust and the stronger fliers, hold their wings horizontally, straight out from the body, whereas the damsel-flies hold theirs vertically over the back. Both kinds are predacious on other, smaller forms of insect life, and the dragon-fly may commonly be seen swooping in pursuit of its prey. Tennyson indicated the swift, purposeful nature of its flight in The Lover's Tale, when he wrote: "... the dragon-fly shot by me like a flash of purple fire."

Among the names by which the dragon-fly has been commonly known are the devil's darning needle, adder's boulte, horse-stinger and snake-stinger. The last name appears in an old song recorded from the Isle of Wight by Weiss (64, p.196). This goes as follows:

"Snake stanger! snake stanger! vlee aal about the brooks;
Sting aal the bad bwoys that vor the vish looks,
But lat the good bwoys ketch aal the vish they can,
And car'm awaay whooam to vry 'em in a pan;
Bred and butter they shall yeat at zupper wi' their vish,
While aal the littul bad bwoys shall only lick the dish."

Of course, the dragon-fly has no sting and is quite harmless except to the small insects on which it gorges itself. The fact that the gnat, which is the mosquito's name in England, is a favoured item of the dragon-fly's diet did not prevent the two from meeting peaceably when the need arose. For, as W. Roscoe wrote in 1806: at The Butterfly's Ball

"... came the Gnat,
And the Dragon-fly too
And all their relations,
Green, orange, and blue."

The colouring of the dragon-flies is often brilliant and attractive and has not escaped the appreciative eyes of the poets. In The Marriage of Geraint, Tennyson records that the prince came galloping through a shallow ford in the sunshine, and up the knoll where sat Queen Guinevere and a maid:

"To join them, glancing like a dragon-fly
In summer suit and silks of holiday."

The delicate iridescence of their wings was also described by Jean Ingelow in the following stanza:

"And forth on floating gauze, no jewelled queen
So rich, the green-eyed dragon-flies would break,
And hover on the flowers--most aerial things
With little rainbows flickering on their wings."

The immature life-stages of dragon-flies are spent entirely under water, so it is understandable that the winged

parents are commonly seen darting or hovering over the surface of the ponds, lakes and streams in which their eggs are dropped or deposited. Elizabeth Barrett Browning associated the dragon-fly with such places, as is shown in one of her finest poems, A Musical Instrument, of which three stanzas are given here:

"What was he doing, the great god Pan,
Down in the reeds by the river?
Spreading ruin and scattering ban,
Splashing and paddling with hoofs of a goat,
And breaking the golden lilies afloat
With the dragon-fly on the river.

"He tore out a reed, the great god Pan,
From the deep, cool bed of the river:
The limpid water turbidly ran,
And the broken lilies a-dying lay,
And the dragon-fly had fled away,
Ere he brought it out of the river."

After carving himself a flute from the reed as he sat on the river bank, Pan proceeded to make sweet music with it:

"Sweet, sweet, sweet, O Pan!
Piercing sweet by the river!
Blinding sweet, O great god Pan!
The sun on the hill forgot to die,
And the lilies revived, and the dragon-fly
Came back to dream on the river."

The young or nymphs of dragon-flies and damsel-flies live for many months on the bottoms of ponds and streams where they breathe through tracheal gills, and feed on insects and other small animal life. When internal development is complete and the winged adult is ready to emerge, the nymph crawls out of the water up the side of a rock or the stem of an aquatic plant. The cuticle splits along the back and the mature insect

crawls out, extends its wings, and in a short while flies away, leaving the empty husk for all to see. This process was observed and accurately described in The Two Voices by the great poet Tennyson:

"Today I saw the dragon fly
Come from the wells where he did lie.

An inner impulse rent the veil
Of his old husk: from head to tail
Came out clear plates of sapphire mail.

He dried his wings: like gauze they grew
Thro' crofts and pastures wet with dew
A living flash of light he flew."

Most of the foregoing quotations relate to the dragon-fly. The damsel-flies, however, were not entirely overlooked. Thomas Moore wrote of:

"The beautiful blue damsel-flies
That flutter'd round the jasmine stems
Like winged flowers or flying gems";

and Browning mentioned that:

"... before him, aye aloof,
Fluttered in the cool some azure damsel-fly."

Both poets correctly described the characteristic loitering, fluttering flight of the damsel-fly, which is in marked contrast to the sure, swift movements of the dragon-fly.

CHAPTER XII

Order Araneida: The Spiders.

"The spider spreads her webs, whether she be
In poet's tower, cellar, or barn, or tree;".

Letter to Maria Gisborne: Shelley.

Although spiders are near relatives of insects and are often mistakenly called by the latter name, actually they belong to a different part of the great Phyllum Arthropoda, the class Arachnida, which also includes scorpions, mites and ticks. While insects' bodies are divided into three definite regions: the head, thorax and abdomen, and they possess six legs, a pair of antennae, and compound eyes in the adult form; the head and thorax of spiders are fused together to form a cephalothorax, and the creature has eight legs, no apparent antennae, and only simple eyes. Furthermore, spiders have no true jaws, the function of the latter being taken care of by a pair of chelicerae which are actually modified antennae. One of the most valuable sources of information on these interesting animals is "The Spider Book" by Comstock (11).

The apparent cunning and predacious cruelty, and the patience and skill of the spider are the qualities that seem to have most impressed the poets and dramatists. Edmund Spenser, in Muiopotmus, or the Fate of the Butterfly, gives a

dramatic description of the capture and killing of an insect victim by a spider. Aragnoll, the spider, jealous of the beauty of Clarion, the butterfly, wove a net in front of his cave to catch him.

"At length, the foolish Flie without foresight,
As he that did all daunger quite despise,
Toward those parts came flying carelesslie,
Where hidden was his hateful enemie."

Then the luckless Clarion was

"With violent swift flight forth caried
Into the cursed cobweb, which his foe
Had framed for his finall overthroe.
There the fond Flie, entangled strugled long,
Himselfe to free thereout; but all in vaine.
For, striving more, the more in laces strong
Himselfe he tide, and wrapt his winges twaine
In lymie snares the subtill loupes among;
That in the ende he breathlesse did remaine,
And, all his yongthly forces idly spent,
Him to the mercie of the avenger lent.

"Which when the greisly tyrant did espie,
Like a grimme lyon rushing with fierce might
Out of his den, he seized greedelie
On the resistles pray; and, with fell spight,
Under the left wing strooke his weapon slie
Into his heart, that his deepe-groning spright
In bloodie streames forth fled into the aire,
His bodie left the spectacle of care."

This habit of capturing, killing and sucking nourishment from insects is common to most spiders, and as there are large numbers of them, both as to species and individuals, and they are widespread wherever insects are found, they do an immense amount of good by helping to reduce the abundance of injurious pests. Perhaps that is the basis of the old English folk-rhyme quoted by Northall (43, p.281)

which reads:

"If you wish to live and thrive,
Let a spider run alive."

In Shakespeare's King John (IV.3), Hubert, suspected of murdering Prince Arthur, is told by Philip the Bastard that:

"... the smallest thread,
That ever spider twisted from her womb,
Will serve to strangle thee;".

The spider's silk, of which a single spider may spin several distinct kinds, does not originate in the "womb", however, but from silk glands in the cephalothorax. Dryden repeated Shakespeare's misconception of the source of silk in Mariage à la Mode (II.1):

"Our souls sit close and silently within,
And their own web from their entrails spin;
And when eyes meet far off, our sense is such,
That, spider-like, we feel the tenderest touch."

Sir John Davies, one of Shakespeare's contemporaries, alluded to one of the orb-weaving spiders in The Immortality of the Soul (XVIII: Feeling), the webs of which, although common in every garden, are considered to be among the most wonderful structures built by the lower animals.

"Much like a subtle spider which doth sit
In middle of her web, which spreadeth wide;
If aught do touch the utmost thread of it,
She feels it instantly on every side."

There are various types of spiders' webs besides the orb-web. One of them, known as the funnel-web, may be the famour "parlour" mentioned in Mary Howitt's well-known nursery rhyme, The Spider and the Fly, which runs:

"'Will you walk into my parlour?'
Said a spider to a fly;
''Tis the prettiest little parlour
That ever you did spy.'"

These spiders spin sheet-like webs with a tubular retreat into which the spider disappears when it has seized its prey. The webs are often found about windows, especially in out-houses and other neglected places. James Thomson, in The Seasons: Summer, has graphically described what happens to the unfortunate flies that go to the window in search of an exit and become caught in the web.

"But chief to heedless flies the window proves
A constant death; where gloomily retired,
The villain spider lives, cunning and fierce.
Mixture abhorr'd! Mid a mangled heap
Of carcasses, in eager watch he sits,
O'erlooking all his waving snares around.
Near the dire cell the dreadless wanderer oft
Passes, as oft the ruffian shows his front;
The prey at last ensnared, he dreadful darts,
With rapid glide, along the leaning line;
And, fixing in the wretch his cruel fangs,
Strikes backward grimly pleased: the fluttering wing,
And shriller sound, declare extreme distress,
And ask the helping hospitable hand."

The spider with its segmented, hairy body and rather gruesome habits is not generally popular among human beings. Especially would the average person recoil from food or drink into which one had fallen. Shakespeare, in the Winter's Tale (II.1) presents in different form the old adage, "what the eye doesn't see the heart doesn't grieve":

"There may be in the cup
A spider steep'd, and one may drink: depart,
And yet partake no venom; for his knowledge
Is not infected: but if one present
That abhorr'd ingredient to his eye, make known
How he hath drunk, he cracks his gorge, his sides,
With violent hefts. I have drunk and seen the spider."

Many people fear spiders because they believe their bites to be venomous. Spiders actually do possess poison glands and inject sufficient poison into insects and other small prey to kill them. However, in temperate regions the venom of the vast majority of spiders would not be enough to cause serious discomfort to humans.* Comstock even discounts the supposed venomous character of the large, vicious-looking tarantula spiders occasionally brought from the south on bananas. However, whether or not the spider is harmless, William Blake, in Auguries of Innocence warns that:

"The wanton boy that kills the fly
Shall feel the spider's enmity."

In medieval times a hysterical disease called tarantism was supposed to be caused by the European tarantula, Lycosa tarentula, and its cure was believed to consist of frenzied dancing to musical instruments for many hours a day, for several successive days. On this subject, Kirby and Spence (31, p.67) stated:

"The effects ascribed to its (the tarantula's) wounds, and their wonderful cure supposed to be wrought by music and dancing, have long been celebrated; but after all there seems to have been more of fraud than of truth in the business; and the whole evil appears to consist in swelling and inflammation. Dr. Clavitio

*The black widow spider (see Plate X) is an exception. Its bite is dangerous.

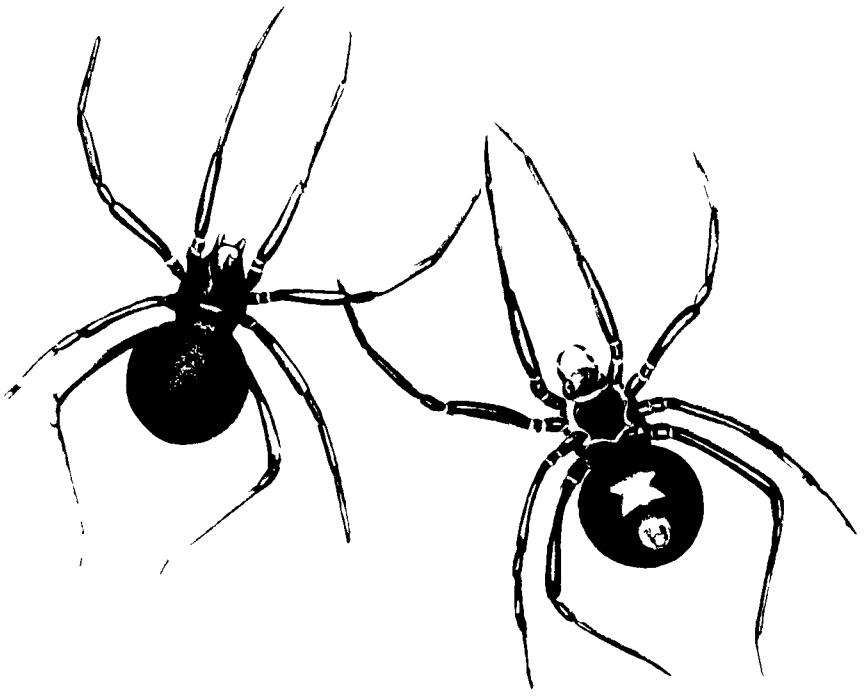


PLATE X - Above: black widow spider female, dorsal and ventral views, much enlarged (after Gibson and Twinn). Below: tarantula spider, somewhat enlarged.

> "submitted to be bitten by this animal, and no bad effects ensued; and the Count de Borch, a Polish nobleman, bribed a man to undergo the same experiment, in whom the only result was a swelling in the hand, attended by intolerable itching. The fellow's sole remedy was a bottle of wine, which charmed away all his pain, without the aid of pipe and tabor."

The results of more recent investigations, as reported by Riley and Johannsen (49), appear to confirm the foregoing conclusions.

In Conclusion

This work has been restricted to consideration of the poetry and drama of England to keep it within reasonable bounds. The literatures of the United States and the British Dominions, however, undoubtedly also contain numerous insect allusions. Walton (60), Wilbur (66) and Eddy (17) have treated the American field to some extent, and the former, particularly, has shown that modern American poets often exhibit special knowledge of insects and write familiarly of species that were unknown to, or escaped the attention of, their English predecessors.

However, as pointed out in the historical summary in Chapter I, published information on insects in England was scanty, inaccurate and not generally accessible until after the end of the seventeenth century. When popular ignorance of entomology as recently as 200 years ago is considered, it must be admitted that the poets and dramatists were often surprisingly accurate in their treatment of insects, and this, no doubt, was usually the result of keen personal observation rather than bookish learning. Of course, they sometimes made mistakes, as illustrated in various parts of the text and broadly summarized in Chapter II, but these usually reflected popular misconceptions, or erroneous beliefs handed down from antiquity, and were excusable, especially in the case of the earlier writers.

Among the poets and dramatists who reveal in their works the widest or most sympathetic interest in the insect world are numbered some of the greatest names in English literature.

The first in point of time in the period under consideration is Geoffrey Chaucer (1340?-1400) whose works contain nearly 40 allusions to insects, mostly in the form of similes. However, he gave certain insects more realistic treatment, notably the clothes moths, fleas, and blowfly maggots, which apparently impressed him by their destructive or unpleasant activities.

John Skelton (1460?-1529) is the sole representative of the fifteenth century in this study. He alluded in a superficial way to five insect orders in the space of a few brief lines in the poem Phyllyp Sparowe, in which a pet sparrow, besides seeking and picking up "flees blake":

"Sometyme he wolde gaspe
Whan he sawe a waspe
A fly or a gnat
He wolde flye at that
And prytely he wolde pant
Whan he saw an ant
Lord, how he wolde pry
After the butterfly
Lorde, how he wolde hop
After the gressop."

Shakespeare (1564-1616) referred to insects in his works more frequently than any other English poet or dramatist. Every one of his plays contains some reference to insect life, the number of allusions totalling nearly 200 and representing

at least seven orders. In this field he is rivalled only by Tennyson (1809-1892), with whom he has a common bond in his profound love of "the soil and scenery of England". At least nine insect orders are represented in the works of the latter, the largest number treated by any of the poets, and although the allusions are much less numerous than in Shakespeare they naturally reflect the more exact and wider knowledge of the nineteenth century. Shakespeare's contemporaries: Spenser (1552-1599), Jonson (1572?-1637), Drayton (1563-1631), and Herrick (1591-1674), all revealed in their works a familiarity with the commoner forms of insect life, as also did the great Milton (1608-1674).

Among the lesser poets who treated rather frequently of insects are the satirical Butler (1612-1680), the parodist Gay (1688-1732), the observant nature lover Thomson (1700-1748), the very minor poet Samuel Rogers (1763-1855), and Thomas Hood (1790-1845). Thomson, several of whose observations are recorded in these pages, is one of the very few who dealt with insect control in verse. This was in The Seasons - Spring, wherein, in the following lines, he gives a description of the primitive control measures practiced (probably ineffectually) against insects by farmers early in the eighteenth century:

> "To check this plague, the skilful farmer chaff
> And blazing straw before his orchard burns;
> Till, all involved in smoke, the latent foe
> From every cranny suffocated falls;
> Or scatters o'er the blooms the pungent dust
> Of pepper, fatal to the frosty tribe;
> Or, when th' envenom'd leaf begins to curl,
> With sprinkled water drowns them in their nest;".

Gentle and lovable Cowper (1731-1800) saw in insects "Nature's most minute design the signature and stamp of power divine;" and described:

> "The shapely limb, the lubricated joint,
> Within the small dimensions of a point,
> Muscle and nerve miraculously spun,--
> His mighty work, who speaks, and it is done."

Burns (1759-1796), Wordsworth (1770-1850), Coleridge (1772-1834), Byron (1788-1824), Shelley (1792-1822), Keats (1796-1821) and Browning (1812-1899) are also among the great ones who wrote understandingly of insects in their works. Tennyson already has been mentioned. There are numerous others, as a perusal of the preceding pages or a glance through the index will quickly show.

From the foregoing study it may be concluded that the knowledge of insects possessed by most of the English poets and dramatists whose works have been examined was of a popular and rather elementary kind. Of the nearly five score authors considered, only about one-third alluded to forms representing four or more orders of insects. The Hymenoptera received most attention, 55 per cent having referred to this group, thanks largely to the ever popular honey bee; the bumble bees, ants, wasps and hornets also received frequent mention. The Diptera come next, with 44 per cent alluding to species of this order, principally to the fly, which is assumed to be that most common form, the house fly; also to gnats (i.e. mosquitoes), blow flies and several other non-biting and biting forms. Forty-two per

cent of the writers mentioned the Lepidoptera, the order containing the varied and beautiful butterflies and moths, and their far less attractive caterpillars. The Coleoptera caught the attention of 40 per cent, chiefly on account of the poetic appeal of the fire-flies and the glow-worms; several other kinds of beetles, and the death-watch also played their part.

Of the other seven of the eleven orders noticed by English poets and dramatists, the Orthoptera, in the form of the grasshoppers and the crickets, attracted 25 per cent; the Siphonaptera (or fleas) 15 per cent; the Hemiptera (chiefly the cicadas) 11 per cent; the Anoplura, (sucking lice) 9 per cent; the Odonata and the Ephemeroptera (dragon-flies and mayflies) 6.5 per cent each, and the Dermaptera (earwigs) 4 per cent. Thirteen per cent also alluded to the Araneida or spiders, which are related to insects but belong to a different class of segmented animals, the Arachnida.

For further details the reader is referred to the text. The names of the poets and dramatists and the titles of their works quoted will be found in the index.

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