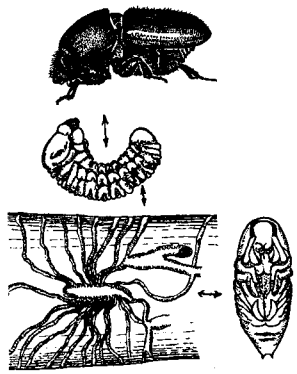
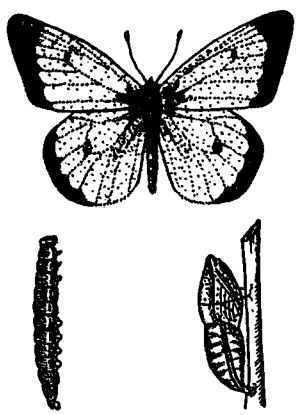
Insect Life in Winter

By E. LAURENCE PALMER

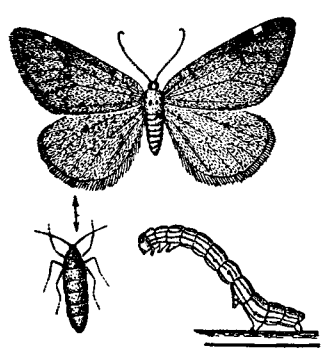
This is the eighty-ninth in NATURE MAGAZINE'S *series of educational inserts.*



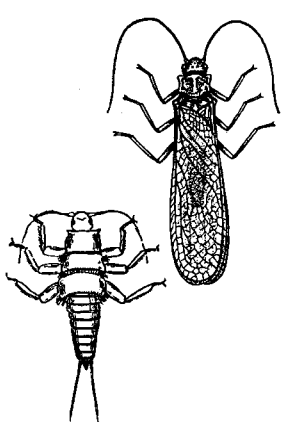
ENGRAVER BEETLE



CABBAGE BUTTERFLY



CANKERWORM

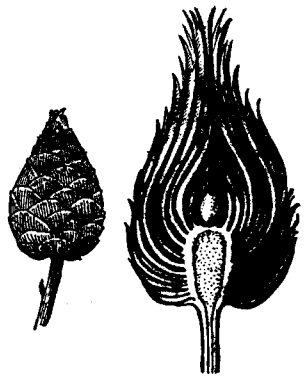


WINTER STONEFLY

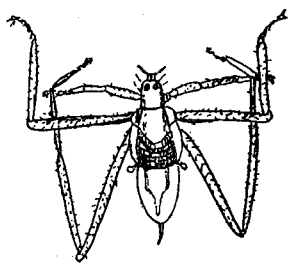
IT MAY sound strange, but the inspiration for this article came almost exactly one year before it was ready to appear in print. Stranger yet, it came not from experiences while hiking in the snow. Instead, it came as I lay in a hospital bed after a serious operation, and while I was listening to my first radio broadcast after that event.

The broadcast dealt with some Nature correspondence the broadcaster had been receiving, and revealed a rather serious hiatus in the experience of that naturalist of the air. As I lay there I began thinking about how an interesting story might be written about insects and the snow. Naturalists are often considered a bit queer, but when one goes into the field in the dead of winter specially to study insects it would seem that an eyebrow or two might properly be raised.

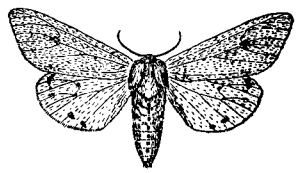
More than forty years ago I found myself charged with teaching natural history, under the guise of elementary agriculture, to a group of rural Iowa teachers. The school outline suggested that, in January, we have a lesson on cabbage butterflies and on insects in general. I could not find many cabbage butterflies, but I did dig out a mass of leaves from under some stones in a creek a short distance from my office. I took the mass into the laboratory, thawed out the ice, and used the insects, which were also thawed out, to show those teachers that insects could be found outdoors in Iowa during a January blizzard. I will never forget that day. I now find myself compelled to decide between studying the host of insects that may be found, any winter day, in almost any stream, or sticking to the original idea of studying insects that can be found elsewhere in such weather. Since the relatively recent 70th insert, and the first insert of this series, dealt primarily with insects in the water I decided to keep my feet and hands dry and warm this time, even though this requires that I give a new slant to consideration of some of the species that have been covered in other inserts. When we are through I am sure that you will feel that the expression the "dead of winter" may need to be qualified at times.



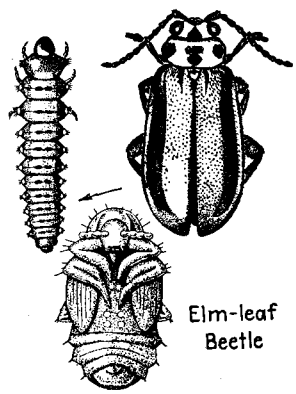
PINE-CONE WILLOW GALL

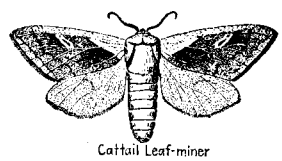


SNOWFLY

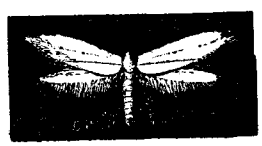


WOOLLY BEAR





Cattail Leaf-miner



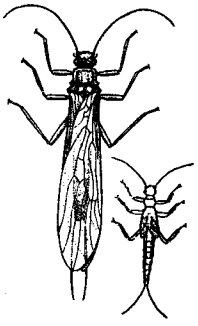
For once we are at a loss to find helpful references to the subject of our insert in *The Bible*, in poetry, or in masterpieces of literary prose. Neither do we know of any great artist who has pictured effectively snow and its associated insects. When I was in the Navy I remember meeting a child in a Chicago museum who was entranced by an exhibit case of white butterflies, and who commented to me that they should be the kind that fly over snowdrifts. So I elect to consider insects seen flying in the air over snow-covered ground; insects to be found on and in plants in the dead of winter; insects seen in dwellings trying to escape to snow-covered outdoors; insects to be found crawling over bare ground while snow is still abundant, and insects to be found on and in the snow itself.

The late Edith M. Patch wrote interestingly in her *A Little Gateway to Science* about mourning cloak butterflies that are likely to be seen in snow-covered woodlands almost any mild winter's day. I am sure that I could go almost to the exact spot where, as a youngster in a Cortland, New York, woodland I first saw a mourning cloak butterfly in the winter. What disturbed me most was the fact that when I first saw the butterfly I saw it distinctly, but by the time I reached the spot where it had been it had vanished completely. While I was looking about in confusion, and with some disgust, the insect suddenly reappeared close at hand. It had come to rest on the dark trunk of a tree, and in that setting it was practically invisible. I know now that I was rather lucky to get a second glimpse; frequently, this butterfly can hide itself rather completely under a piece of loose bark. Apparently sub-zero temperatures do not cramp the behavior of this butterfly, which is almost black if seen with its wings folded, but it has been my experience that bright sunlight does seem to have a stimulating effect, and I have seen them more frequently in late winter than earlier in the season. To me the most remarkable thing about a mourning cloak is not the beauty of the creature, with its wings spread, but the almost perfect camouflage effected by folding those same wings. Even the outline of the folded wings and the light outer border is more effective than would have been the case were the wings solid black and the outline evenly cut.

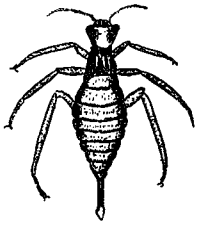
The same woodland that may show you a winter mourning cloak may also provide you one or more little moths flying about. The chances are rather good that these may be

CLUSTER FLY

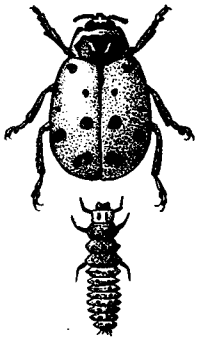
OYSTER-SHELL SCALE



EARLY SPRING STONEFLY



BLACK BOREUS

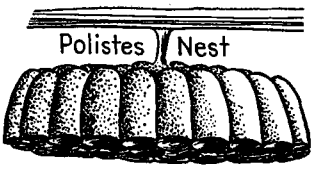


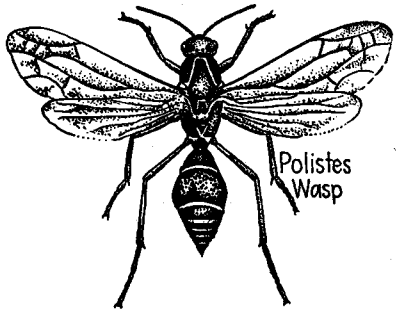
CONVERGENT LADY BEETLE

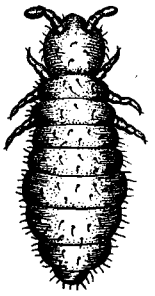
adult moths whose eggs develop into the "measuring worms" that may annoy you by dropping on you in early summer. The chart section will show you the interesting life history of these little, winter-flying moths, and should induce you to watch a flying moth to see if you cannot find the wingless female, which the male is in all probability seeking when you see it. These females hide in the crevices in the bark of trees, unless they get entangled in a sticky band put on the tree. One of the best means of controlling these insects is to prevent the wingless female from getting to a tree top to lay her eggs. You may find evidence, however, that a female cankerworm made the trip successfully if you find one of its egg masses, usually encircling some twig. These cankerworm egg masses do not resemble the varnished masses made by the tent caterpillars. Usually, however, the cankerworm egg masses do not have long to survive the weather. Usually, too, you feel as though the cankerworm moth left her job incompleted because it looks as though the egg-laying was just casually discontinued.

In country where sugar maples grow, almost any mild winter's day will afford quite a number of honeybees that have come out to feed on the sugary sap that has oozed from some broken twig. A bee's life is a busy one and, in part because of the drain on the stored honey by the wintering colony, it becomes necessary to restore the supply whenever this is possible. How far bees travel from their home colony to get food in winter I do not know, but I have seen bees that must have been caught by a quick change in temperature, or the weather, and who obviously did not make it home again. Sometimes these are even to be found on the snow.

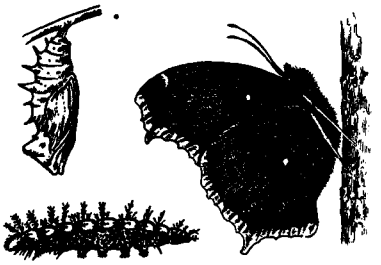
We have already mentioned the possibility that white cabbage butterflies, so abundant later in the season, may sometimes be seen in the dead of winter. This is due to the fact that adults commonly winter successfully and respond rather readily to any suggestion that if winter comes spring cannot be far away. When it comes, they want to be the first to be on the job when any mustards show themselves. The chart sections suggest some interesting variations that take place, both in males and females, as the season advances, and suggest how you may learn to recognize, in a museum collection, the cabbage butterflies that were in an early season generation and those of the come-later crop. It may be nice to think that a white butterfly could easily use white snow as a camouflaging background, but it is difficult to imagine







SNOWFLEA



MOURNING CLOAK BUTTERFLY →

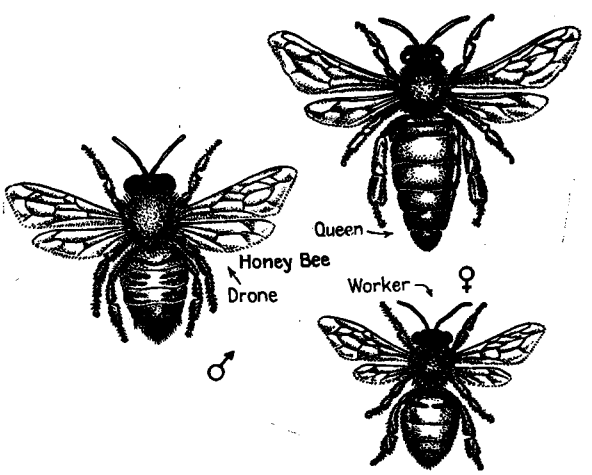
where such a butterfly, or its young, could get a meal at such a time.

There are too many insects to be found hiding on and in plants in winter for us to more than mention a few, and these should be so conspicuous that almost anyone can find them on a winter field trip. We suggest investigating some of the scale insects to be found on the twigs of woody plants, these being representative of insects that live on bark in winter. Seek out a borer like an engraver beetle, which lives under the bark in winter, but whose presence can be detected. Find some insect that creates a change that may be recognized at a considerable distance in herbaceous plants, as is the case with the work of cattail moths. Or look for some insect-produced gall, such as the pine-cone willow gall found at the tip of willow twigs in winter. Once you seek these insects you should find others living similar lives.

Almost any woody plant is likely to have some scale insects on it, but ash, apple and dogwood are often spectacularly infected, so your chances of having good luck may be increased if you examine these plants first. Usually, too, you will be more likely to find your critters if you examine finer twigs rather than the coarser parts of the trees. I admit that, superficially, there is no glamor in a scale insect on a twig comparable with that of a mourning cloak butterfly fluttering through the woodland, but the scale insect does more damage to our apples and other fruit trees, our ashes and other timber trees, and our dogwoods and other ornamental shrubs. Whether we like it or not, we should know more about the scale insects than about a winter butterfly or moth.

The chart section should supply sufficient details of the life history of our scale insects, so no further elaboration is necessary. Do you have any idea what you may find under those scales? Have you any hunch as to any sex difference suggested by any of these scales? How do you account for the fact that scales are crowded on single twigs rather than widely distributed over a tree, or over a group of trees? These are some of the questions the charts should help you answer.

I doubt if there are many readers of these pages who have built fires in the woods from fallen wood and who, in so doing, have not at some time discovered the work of engraver beetles of one sort or another. When the bark is peeled from such wood there is usually left exposed the gouged-out trails left by the larvae that ate their way between the bark and wood as they grew in size. If you have a burrow of a true engraver beetle it may have the common brood chamber where a space was enlarged and in the walls of which the eggs were laid. From this central chamber the grubs worked their way outward. Can you find the trails of any of these that cross each other? Do you know the romance of that initial chamber? Can you find the "shot holes" made by the adults that emerged from the end of the tunnels? Notice how these differ from true shot injury in that none of the holes shows splinters such as are caused by real gunshot. Our engraver beetles provide a story the plot of which should intrigue a writer for the movies. Surely it would be much better than some of the plots presented to us in the theatre and over television.



If we were Nature fakers we could write a good story about what lies behind the production of those pine-

(*continued on page* 32)

COMMON NAME SCIENTIFIC NAME	SNOWFLEA *Achorutes nivicola*	EARLY SPRING STONEFLY *Allocapnia* *(Capnia) vernalis*	WINTER STONEFLY *Taeniopteryx nivalis*	OYSTER SHELL SCALE *Lapidosaphes ulmi*
DESCRIPTION	Members of group rarely to 1/5-inch long. Some may spring into air by suddenly releasing bent-in "tail." Wingless, with 6 short legs and rather short, stout antennae. Eyes degenerate. Mouth parts suited for chewing and sunken into head with only tips at surface. Some species can leap while others cannot do so. Six or less abdominal segments.	Adults appear from early January to late April. Adults are less than ½-inch long, with males smaller and more slender than females. Dark brown to blackish, with hind wings folded to lie under the forewings when at rest. Terminal appendages of abdomen extend beyond wing tips. Antennae held to point forward.	Adults may appear from January 1 to May 1, emerging from aquatic nymphs and crawling about on snow. Adult is ½-inch long, slender, blackish-brown with smoky transparent wings, which equal length of body from snout to abdomen tip. Antennae held forward, about body length. Squarish head narrower than thorax. Wings overlap flat at rest.	General appearance like that of crowded oyster shells on bark of woody plant twigs. The related San Jose scale is more circular than is this species. Females are found under scales about ⅛-inch long, while males are found under the smaller scales. Males become winged, but females remain wingless.
RANGE AND RELATIONSHIP	Order Collembola. Family Poduridae. May appear in great swarms on snow in late winter making it black. Related *A. armatus* collects on fungi; *Podura aquatica* on standing fresh water; *Anurida maritima* along tide marks of shore of salt or fresh water. Some may swarm over clothing of human beings if they are present when abundant.	Order Plecoptera. Family Capniidae. Only one species east of the Rockies, but many related species found in northeastern North America. *A. mystica* appears late November to mid-February; *A. recta* from late November to late February; *A. granulata* from early January to late April or earliest May, all, of course, in genus *Allocapnia.*	Order Plecoptera. Family Perlidae. Ranges from eastern and central United States south to North Carolina. Found on snow near swift water of freshwater streams. Adults seem less alert than do the nymphs. Often may be abundant in great numbers, blackening the snow and crowding the tops of fenceposts and other exposed perches.	Order Homoptera. Family Coccidae. Worldwide distribution. This species is found on dogwood, maple and apple, with closely related species found crowded on twigs of ash and willow. Under some circumstances scales may completely cover the bark of twigs, with such infestations usually causing death of that part of tree.
REPRODUCTION	Obviously seasonal, but little known of life history except that young are much like the adults, there being incomplete metamorphosis, or at least no conspicuous age differences accompanied by conspicuous changes in the general appearance. Some authors claim there is no metamorphosis. They are primitively and entirely wingless.	Adults emerge from nymphs at water's edge and fly or crawl awkwardly upward, find mates, breed and, after this, females turn back to water to lay eggs and die. Eggs hatch into nymphs that spend nearly a year under water, developing to a size where they can emerge from water and from nymphal case to the ultimate in their life experience.	Where adults emerge in large numbers, shed skins of nymphs may appear in layers at water's edge. Adults may mate, then lay eggs in stream and die, with mating taking place away from water in which eggs are laid. Adults are short-lived but complete life cycle requires at least one year, although the adult stage may be most conspicuous.	Winter is spent in egg, although, of course, the scale is conspicuous throughout year. There may be 25-100 eggs under a scale. In late May nymphs emerge from under scale, crawl around for 3-4 hours then form their own scale, pierce stem to reach food and settle down for life, which may end in August. May be 2 generations a year.
ECOLOGY	Some species may swarm around vegetables; some on sap of trees, particularly from sap buckets; some feed on molds; some on algae; some on decaying vegetable material. Some are carnivorous, feeding on smaller snowfleas. Some, like *Isotoma palustris,* do not feed in winter, but in spring feed ravenously on diatoms and similar plants.	Adults probably eat nothing although they seem to have functional jaws. Nymphs feed on aquatic plants and animals and require water with high oxygen content, so are usually limited to swift streams with good volume through the year and with abundant shade, such as may be found in gorges. Normally cannot live long in aquaria.	Adults do not eat, fly little and are probably more active at night than by day. May crawl, not leap, over snow, making way usually to some elevated perch. Emergence is commonly from exposed stones in swift water. Related *Strophopteryx fasciata* is more local, but both species may be found emerging simultaneously from same stream.	Female lays eggs under scale that has protected her through her life, and food is sucked from plant host under that protection. In the year the first eggs on an apple tree, for example, may hatch about 2 weeks after apple-blossom time. The adults are active only during the summer months.
ECONOMY	Economic importance, if any, is usually negligible. Theoretically may pollute sap collected in sap buckets, but this is hardly significant. Some may be pests of succulent garden plants, and some surely assist the fungi in reduction of dead plant material to original state of "nothingness," although technically, of course, this is not a true statement.	Of no direct economic importance, but both adults and nymphs undoubtedly serve important role in supplying food to the usual fishes of their habitat. They may, incidentally, serve as destroyers and consumers of other insects. In addition to the stoneflies here considered there are other species appearing in warm times.	Since adults do not eat they are of little economic importance, except that apparently they are fed on by some birds. Nymphs feed on both plants and animals under water and form an early link in the food chain of aquatic plants to swift water species of fishes. While these are too small for bait, they are excellent food for game fish species.	Control is largely through destruction of infected material and through use of lime-sulfur spray applied regularly in 10% kerosene emulsion when plants are dormant, and a soap spray applied in late May when adults may be free and moving about, seeking to start a new infection and a new generation, of course.

Lady Beetle *Hippodamia convergens*	Elm-Leaf Beetle *Galerucella luteola*	Engraver Beetle *Scolytus rugulosus*	Black Boreus *Boreus brumalis*	Cattail Moth *Lymnaecia phragmatella*
Length about ¼-inch. Appear like a small split pea. Shows two white converging dashes on back, in front of wings, 13 black dots on orange wing-covers and a white border on thorax. The legs are relatively short and slender. There are lady beetles, or ladybird beetles, that are red, black or yellow-spotted, or some entirely black.	About ¼-inch long. Dull yellow with black spots on head and a black band near the outer edge of wing covers. Sometimes the whole aspect of the beetles is grayish. During hibernation as adults color may change from yellowish to dark green.	Length about 1/10-inch. Width about 1/30-inch. Uniform black except wing cover tips and parts of legs, which are red. Wing covers about ½ total length. Evidence of presence in winter indicated by burrows in wood under bark, or "bullet holes" in bark, even though these are records of earlier activity, except if new in late spring.	Length to about ¼-inch. Front of head forms a trunklike prolongation. Abdomen much wider than thorax or head and female with long ovipositor. Legs slender, long and rather clumsy when in action. From above head looks like that of some dragonfly nymphs with prominent eyes. Wings of males poorly developed; of females vestigial or wanting.	Adult moth with wingspread of about ¼-inch, with wings at rest held like sides of a roof, straw-colored, slender, pale and silky. Has 2 conspicuous dots surrounded with white on the forewings. Hindwings are pale gray and hidden by forewings when at rest. Female is stouter in abdomen than is the male.
Order Coleoptera. Family Coccinelidae. There are about 100 species of lady beetles to be found in North America. Most of them are useful, but some like the Mexican bean beetle may become serious pests in some areas. This pest has spread from the Southwest to New England, and probably will continue to spread in the future.	Order Coleoptera. Family Chrysomelidae. Introduced into America from Europe near Baltimore about 1834 and now widely distributed over the country wherever elms, and particularly the English elm, are grown as shade trees. They are now firmly established in the fauna of our country, unfortunately.	Order Coleoptera. Family Scolytidae. This species ranges from Alabama north into Canada and west to Michigan, with closely related forms on west to coast. This species burrows in trunks and branches of apple, cherry, peach, pear and related species. Burrows under bark look like long-legged spiders with "legs" slenderest at base.	Order Mecoptera. Family Panorpidae. Not uncommon in eastern United States, but usually not noticed by casual observer. The related brown boreus, *B. novoriundus*, and the English, *B. hyemalis*, are more easily observed in winter than in warmer weather because of the white snow background over which they move rather awkwardly. Western species, 2.	Order Lepidoptera. Family Cosmopterygidae. Common wherever there are cattails, and cattails are worldwide in distribution, being found in both Americas, Africa, Europe, Asia and Australia where climatic conditions, particularly as to water, are at all suitable. Has a limited food range and so is restricted in range as above hinted.
Eggs are laid in spring after adults have hibernated, usually in great numbers crowded into a small area. Larvae, when first hatched, begin eating other small insects, insect eggs and even spiders. They grow rapidly and finally, when mature, pupate. Pupae hang by tails for few days before transforming into adults, completing cycle.	Yellow-orange eggs, laid on end in clusters of 5-30 on elm leaves, hatch in about 1 week into larvae, which are yellow and black and mature in 2-3 weeks, spending most of the time on elm leaves eating out all soft parts and leaving little besides the tougher skeleton. Pupate in ground for about 10 days. May be 2 generations a year.	In some species males, in others females, enter old burrow, enlarge it into chamber in which females are mated and in walls of which new eggs are laid. Eggs hatch into larvae that burrow just under bark, making increasingly larger tunnels until mature. After pupation adults make way through bark, causing characteristic "bullet hole" effect.	Eggs of European boreus are laid in early winter, deep in masses of moss, and, at temperature of 47°F., may hatch into larvae within 10 days. Larvae of *Boreus* lack abdominal prolegs. Pupal stage in most members of genus *Boreus* may be spent in earthen cell underground, but near the surface. Some larvae and pupae in moss and bark.	In winter, as larvae in stems or heads of cattails, presence often indicated by fluffing out of head. Pupates about 30 days in 2/3-inch, tough, white cocoon in stem or head of cattail in early spring. Adults emerge in May and lay flattened eggs on cattail spikes. Develop into ½-inch yellow-white larvae with red-brown markings.
Food of this species includes eggs and larvae of such pests as potato beetles, grape rootworm, asparagus beetles, chinch bugs, alfalfa weevils and bean thrips. There are few insects that help farm and orchard crops more than do the lady beetles. In West the fall hibernation is usually at higher elevations than where most of life is spent.	Adults, hibernating in houses, may crowd on windows in spring, seeking way to trees. Some may come out on warmer spring days when snow is still on ground. Earliest destruction of buds may be reflected in leaves with a series of holes caused by injury in young stages. Both adults and larvae are destructive of elms.	Larval stages may last 30-36 days, egg stage 3-4 days, pupal stage 7-10 days. Larvae of this species look like yellow-headed white grubs. In slash pine beetle an unusual thing takes place when males provide the burrows not only for one but for many mates. In that species there may be 2 generations with one wintering as larvae.	These "snowborn" insects seem something like injured craneflies. They may appear on the snow in early winter, but their abundance may increase as the winter advances. Sometimes newly fallen snow may be sprinkled abundantly with them over areas of a number of square feet. They may appear in abundance on the snow as late as March and April.	There is but one generation a year. Adults eat nothing. Larvae feed freely on tissue of stems, leaves and heads of cattails, the retreat to head and fluffing of head providing a superior insulation against the severities of winter and making larvae generally inaccessible to animal enemies. Has few natural parasites.
Convergent lady beetles are collected in hibernating area by the ton. Some 30,000 are considered adequate for protecting 10 acres of cantaloupes from destructive scale insects. They are a recognized commercial product. Related destructive Mexican bean beetle is controlled by spray of magnesium arsenate.	Cause great damage to valuable shade trees, and much money is spent in their control by use of sprays. Usual practice is to apply lead arsenate just after buds open to kill wintering adults, with a second spray 2 weeks later to kill larvae that survived first control measure. Possibly adults could be trapped in winter.	Highly destructive group of beetles, not only because of direct injury but because of introduction of fungi as of Dutch elm disease. Some trees drown larvae with sap. Infected slash should be burned to destroy insects; white-washing fruit trees in March, July and October may help. Demonstrated that resins offend and sap attracts adults.	There is little likelihood that these insects are of any economic importance whatever. Their consideration is made here solely because of the fact that their presence on snow frequently arouses interest. The illustrations show how conspicuously they differ from most other "snow insects."	Little, if any, economic importance because of small economic importance of cattails and because of minor injury caused to the host plants anyway. Moths might serve as a minor source of food for some marsh birds since they are abroad while some marsh birds seek food for their young.

COMMON NAME SCIENTIFIC NAME	CANKERWORM *Alsophila pometaria*	WOOLLY BEAR *Isia isabella*	CABBAGE BUTTERFLY *Pieris rapae*	MOURNING CLOAK BUTTERFLY *Aglais antiopa*
DESCRIPTION	Wingspan of male 1-1-1/5 inches. Female practically wingless. Male of fall cankerworm, *A. pometaria*, darker smoky or brown-gray than that of spring cankerworm, *Palaecrita vernata*, and with a distinct whitish spot on front edge of the forewing. Females are, in general coloration, like the males but are wingless as suggested.	Wingspread of moth to 2 inches. Forewings of male buff brown with small black spots. Hindwings straw-colored. Body dirty orange with black spots. Female similarly colored or may have flesh-colored hindwings. Body rather stout but narrower than thorax. Antennae slender and about 1/3 length of forewing.	Wingspan to 2 inches. Male with forewings white, black-tipped above and with 1 black spot, which may sometimes be absent in spring individuals. Hindwings white above and yellowish beneath. Female much like male, but forewings have 2 black spots instead of 1, and these may be smaller in spring individuals. Wings folded at rest.	Wingspan to 3½ inches. Male with maroon forewings, with broad straw-yellow borders, with blue spots on upper surface, almost black beneath, as shown with wings folded. Hind wings much like forewings but with suggestion of "tails." Female generally similar to male in pattern and coloration. Rare variety has wide, straw-colored border.
RANGE AND RELATIONSHIP	Order Lepidoptera. Family Geometridae. Fall cankerworms are found in injurious numbers through northeastern United States and, in some numbers, west to California. Spring cankerworms are more eastern. The related cankerworm of Europe was mentioned in a 1611 edition of *The Bible*.	Order Lepidoptera. Family Arctiidae. Common in northern United States from the Atlantic to the Pacific, where it is best known in the caterpillar stage as woolly bears that are seen crossing highways in the fall or spring in varying degrees of haste and effectiveness. Related smaller yellow-bear caterpillar moth is *Spilosoma virginica*.	Order Lepidoptera. Family Pieridae. Common over wide areas but limited to Temperate Zone. Three groups of the family, the whites, the yellows and the orange tips are recognized in eastern United States. There are at least a dozen species of whites to be found in North America, and many of the other groups. Introduced into America about 1866.	Order Lepidoptera. Family Nymphalidae. Found throughout all temperate regions. In America gets south to Guatemala. Known in England as Camberwell Beauty although it is rare in that country. May come into houses. Most common near woodlands, June-August. May be found flying through snow-covered woodlands in dead of winter.
REPRODUCTION	Female lays several hundred gray eggs in rows on the bark or twigs of deciduous trees, usually in fall or even in spring. These hatch into measuring worms when the leaves appear and feed about 1 month, when they drop to ground at end of long thread. There they pupate 1-4 inches underground. Males fly to mate with crawling females.	Females lay nearly 1000 eggs, yellow, spherical, slightly spaced in patches. Caterpillars furry, red-brown, with black ends, when young are social, and when grown may lose much of black ends. Winter as caterpillars under trash, feed in spring, then pupate under cover in cocoons made of silk and caterpillar hairs. Pupate about 2 weeks.	Winters as pupae or as adults. In North there are three generations a year; in South, to 6. Eggs are yellow, flask-shaped, with 12 vertical ribs, usually laid singly on under side of leaves of food plants. Hatch in about 1 week. Larvae are green, slightly hairy, with yellowish back band, to 1 inch long, maturing in 2-3 weeks before pupating.	Dark brown to black, barrel-shaped eggs laid in rings around twigs; hatch in 6-16 days depending in part on temperature. Mature larvae to 2 inches long, with angled head, black body and head. Body spined and white-spotted with red on middle of back. Prolegs reddish. Group stays together. Pupate on twigs, 8-16 days, dark brown with red points.
ECOLOGY	Food of caterpillars largely leaves of deciduous woody plants. When leaves are destroyed new forage may be reached by being blown by wind at end of silk. Control may be effected by spraying and by preventing crawling females from reaching treetops, where eggs will be laid. This is done by sticky areas around the trunks.	Food of caterpillars a variety of plants, with only slight preference being shown. Cocoons are commonly found under stones and boards, or sometimes on fences, and are well known by any amateur naturalist. No relationship whatever between length of winter and percentage of black and brown on caterpillars. Young more black than old.	Pupae green, slender, angular, to 5/8-inch long on some support, lasting 10 days to over winter. Food of larvae is primarily cabbage and the closely related mustards. Caterpillars may eat way into heads of cabbage ruining their commercial value. Chickens that may eat the larvae or pupae may be adversely affected by them.	Caterpillars feed on leaves of willow, poplar, elm, hackberry and other trees. Working as a group they may clean a branch completely of its leaves. Adults feed on nectar collected through long curled proboscis. This is one of the largest of the butterflies in its range to winter in the adult form.
ECONOMY	In years favorable for cankerworms whole trees may be denuded and weakened. They may be among the worst enemies of shade trees. Both males and wingless females may be found on or near trees, even when snow covers the ground, even though escape from underground pupae must be made through snow-covered ground at times.	Of little or no economic importance because they do not specialize on plants of economic importance. Rarely sufficiently abundant to be considered as pests. Skunks and some other animals roll caterpillars to remove hairs before eating them. Make interesting animals for home or school terrarium.	Obviously of negative economic importance. Control is by spraying and by hand picking. Not infrequently in early spring, before the snow has left the ground, adults may be seen flying over fields. They may have wintered in the shelter of some building and come out when atmospheric conditions at least indicated nearness of spring.	Sometimes this species is considered as a pest because of its destruction of portions of useful shade trees. However it never reaches the population numbers of many of its relatives and can hardly be considered as a pest when compared with them. Some degree of control may be effected by the collection of egg masses found on twigs.

SNOWFLY *Chionea valga*	CLUSTER FLY *Pollenia rudis*	PINE-CONE WILLOW-GALL GNAT & GUEST GNAT *Rhabdophaga strobiloides* and *Cecidomyia albovittata*	POLISTES WASP *Polistes sp.*	HONEY BEE *Apis mellifica*
These look like 6-legged spiders since superficially they show no wings. Wings are reduced to the merest knobs and are in no sense functional. Of course, 6-legged character separates them from 8-legged spiders. The average cranefly looks superficially somewhat like a large mosquito. Legs are hairy, body ¼-inch.	Length to about 1/3-inch, slightly larger than housefly, sluggish in behavior, with wings not so widely spread as those of housefly. Thorax dark, woolly with hairs. Abdomen brown with pale spots. Space between eyes white. When smashed, leaves a greasy spot and gives off disagreeable odor at times.	Since the presence of these insects is more easily recognized by their habitat than by the insects themselves we consider the pine-cone willow gall. It appears at the tip of pussy-willow twigs and looks coarsely like a pine cone. In its heart in winter is the larva of the gnat, and, between the "scales," the guest.	Length of adult 1 inch or more. Long slender, dark brown to black with red spots on the abdomen and with one or more yellow rings. First abdominal segment is narrowed in front, unlike the broad and blunt counterpart in the yellowjackets. Male has a pale face and shorter antennae than the brown-faced female.	Worker or sterile female about ½-inch long may be seen in winter on warmer days feeding on sap from broken twigs of maples and similar trees. Drones and queens to ¾-1 inch long not likely to be seen in open in winter. Swarms of 60,000 bees probably all of one colony. Workers live 1-2 months; drones, 1-2 months; queens years.
Order Diptera. Family Tipulidae. The generic name *Chionea* refers to snow. The related *C. araneoides* found in New York State has had most of its immature stages and its general biology described in some detail. Members of the genus are to be found throughout the North Temperate Zone, including some 8 species.	Order Diptera. Family Calliphoridae. Introduced from Europe at an early, unknown date. May be found on snow acting as though partly frozen, but commonest on windows exposed to the sun. With falling temperature seeks darkness when thermometer reaches 50°F., but with rising temperature seeks light at same temperature.	Order Diptera. Family Cecidomyiidae. Host plant, *Salix cordata*, is widely distributed. Location on the plant is relatively limited to an end bud in whose developing leaves, at an early stage, an egg *Rhabdophaga* was laid. The range of *Cecidomyia albovittata* is restricted by presence of gall caused by *Rhabdophaga*.	Order Hymenoptera. Family Vespidae. Closely related to the hornets. There are 4 variable species of *Polistes* in United States and about 50 in the world. *P. annularis* has showy yellow margins on last abdominal segment, *P. pallipes* a uniformly brown abdomen; *P. variatus* has many yellow spots and bands.	Order Hymenoptera. Family Apidae. Are domesticated world over and related wild species are used as a source of sweets. Must have suitable nectar-bearing plants for food source, but may be found in forests, fields, parks, or even in heart of cities in bee trees, or in artificial hives. Food of adults mostly pollen and nectar.
Adults may come out on snow in bright sunlight and mate even when temperature is down to zero. Females usually appear in early morning. After mating, female works way down into snow, or, if possible, down to earth and lays elongated eggs, which hatch into pale yellow larvae. These develop into pupae and then into adult stage.	Adults mate in February and first warmish day may lay eggs on garden soil or in lawns. Eggs laid about 1 month after mating, one laying to nearly 100 an evening. Eggs hatch in 4-6 days into white, legless maggots that parasitize living earthworms for about 3 weeks, then escape to soil. Pupate 2-6 weeks and then, as adults, repeat cycle.	*Rhabdophaga* lays an egg in willow bud. Egg hatches into larva and bud develops into a gall. Larva lives in heart of gall through summer and winter, pupating in early spring. Adult emerges and lays eggs. *Cecidomyia albovittata* lays egg between "leaves" of gall. Egg hatches and larva develops as guest in gall caused by *Rhabdophaga*.	Female lives through winter after having mated with male, who dies. She may appear in warm spells on windows. In spring she builds a paper nest in sheltered spot with downward-pointing cells but no cover beneath. In these the eggs are laid and the young reared. Grubs hang downward and are fed nectar and insects.	Queens and drones mate in flight in summer. One fertilization effective for 8 years. Fertile queen usually starts new colony. Wax comb built by bees or man. Eggs laid in comb develop into larvae; pupae and adults cared for by workers. Egg to adult queen 15¼ days; to worker 21 days; to drones 24 days. Drones from unfertilized eggs.
Obviously these insects are affected by light and temperature, judging by their behavior, since they emerge on snow most commonly on mild, sunny days. Apparently move upward with rising temperature, but after mating the females, at least, tend to work their way downward, probably to a place where eggs may be laid effectively.	Food of larvae is earthworms. Of 107 earthworms examined 74 supported 87 cluster fly maggots. In addition to reacting to light at 50°F., the flies push against contact below that figure and avoid it above that figure. Flies may be trapped by light, using data given above, or may be killed by DDT sprays around windows or on flies directly.	Illustration shows larva of gall gnat and of gall guest gnat. Apparently guest is wholly dependent on gall gnat to make gall which it needs. The gnats are smaller than mosquitoes and look superficially like them. The whole gall, gall-gnat, gall-guest-gnat, willow arrangement is much like a boarding house, with the gall gnat the responsible host.	Pupae are in silken cocoons in nest and adults emerge to mate and build another nest and complete the cycle. Nest is supported by a single stem, is waterproofed by new material licked on by female. Food not ordinarily stored, since young are fed as needed and female hibernates. Nests may be built in colonies.	In queenless colony new queen may develop from queen cell, or from egg or worker larva not over three days old by enlarging cell, changing food from beebread to royal jelly. Would take one bee working alone 64 years to produce 1 pound of honey, or 50,000 bees working one hour to do the same. Useless drones are killed when appropriate.
It is doubtful if there is any economic importance to these insects, but there is no doubt but that they intrigue the imagination of those who may see them at least for the first time. Some of their relatives, like the Hessian flies, may do great damage to crops, but no such relationship is recognized with the snowflies.	Common strength of suitable spray is 1 pound of 50% wettable powder, or one quart of 25% emulsible concentrate in 6 gallons of water. This may be applied to screens, walls, ceilings, floors, or wherever flies may be found. Greatest concentrations in fall or spring as outside temperature hovers around 50°F. Natural enemies of useful earthworms.	There is little possible economic importance in this whole arrangement but it is intriguing to the naturalist and since it is conspicuous in winter when snow is on the ground and involves insects it seemed appropriate to give it this rather unusual recognition in this part of the chart section.	Possibly of some economic importance as destroyers of other insects. Common about houses and school rooms in fall and spring. Are feared more than justified since they may be handled gently with almost perfect safety, although they are perfectly capable of doing serious stinging if forced to do so.	One pound of honey represents 20,000 bee trips averaging 1 mile a trip. Possibly most valuable of all insects because of production of honey and wax and also because of service in pollinating plants, particularly the flowers of important fruit trees. United States produces about 500 million pounds of honey a year, 10 million of wax.

(*Continued from page 27*)
cone like structures you see so frequently at the tips of willow branches on a winter's walk. Again our chart section provides you with most of the details. Some of the insects involved in this story are so small that you in all probability will never see them. But you can see easily the work they have done and may understand the variety of interests involved. In this story we are challenged by the fact that an insect can lay an egg in an opening willow bud, and that the resultant larva may so affect the bud that, instead of forming a normal twig, it develops into a waterproof house in the center of which is an ever-ready supply of food. And, apparently, the more this food is consumed the greater is the production of that food. And yet man prides himself on his superior mastery of the world in which he lives. Of course, our story is not complete unless we recognize that in the rooms between the leaves of this gall house live the larvae of other insects that probably never see the creature that caused the house to form, never pay rent for use of these rooms and probably never even visit with their landlords. When we understand this story we sometimes wonder at man's conceit.

Cattails are worth study at any time of the year, but in winter they may be especially interesting. Many a time, when my hands were cold, I have stopped and filled my mittens with the fluff of a cattail top, thus finding that my hands became warm quickly. Many times, too, when I did this I found a little caterpillar hidden in the fluff. Some of these larvae are yellow and about one-half-inch long, and they develop into the cattail moth considered in the chart section. Farther down in the stem may be a larger larva that reaches a length of two inches and is sought by fishermen as bait for fishing through the ice. This may be the larva of the cattail miner, *Arzama obliqua*, which is not ordinarily found in the cattail head. We show the picture of the moth but not a picture of the larva.

We must confine our consideration of most of the insects found in the house, and apparently trying to get out into the snowy landscape, to what appears in the chart section. Almost any winter window, late in the season, should provide good collecting if you seek ladybird beetles, polistes wasps, cluster flies, or elm-leaf beetles, with the last mentioned being the least likely to be found. Attic windows often provide better collecting than other windows in a house when you seek these insects. The school page that supplements this insert gives emphasis to the study of these insects.

And now we get down to consideration of insects on the ground, or on the snow, in winter. One of the commonest of these is also one of the most misunderstood. By some it is sought because it is rumored that the length of the winter can be predicted by the percentage of black to be found on a woolly bear caterpillar. It might be equally effective to predict the length of a season by examining the percentage of white hairs on a man's head. Young men and young woolly bear caterpillars are likely to have a larger percentage of their hairs black, and that is about all there is to this superstition. Old men who still have their hair may have it turn white, and mature woolly bear caterpillars have the black areas at each end taken over by an increasing area of brown. These caterpillars, young and old, may live through the winter. On some mild winter day they frequently may be seen moving across some bare, earthen space.

I have seen approximately half of the kinds of insects mentioned in the chart section on snow itself. In late winter cluster flies that have escaped from a house or barn frequently may be seen. They walk clumsily over the snow, or may make their way to some bare earth. Early in the spring they lay their eggs on this earth and from the eggs develop larvae that live in the bodies of earthworms. It is a case of the early fly that gets her worm as a home for her youngsters.

Near rapidly flowing streams in early spring the snow may be almost covered with adult stoneflies of one sort or another. We present two, and you may become sufficiently interested to try to see adults emerging from their nymphal cases on stones that rise, temporarily at least, above the dashing icy water of the stream in which, until now, the insects have lived their whole life. While these adult stoneflies can fly, they do not leap as do some other snow insects. They mate and make their way to some elevation, such as a fence post, from which they again take flight and return to the stream to lay their now fertilized eggs.

The common name black boreus should suggest a black critter that is conspicuous in winter, if ever. This is true of a little black scorpion fly that is only about one-quarter-inch long, has six long spiderlike legs and a proportionately large head. The female has a long egg-laying structure to the rear. The wings of the males are poorly developed, and those of the females either wanting or vestigial. These little insects may come out on the snow, find mates and return to some exposed moss or other vegetation, where they lay their eggs, which, in about ten days, will hatch into larvae. Their abundance seems to increase as the winter advances. Were it not for six instead of eight legs one might guess that a boreus was a spider.

Another spiderlike creature to be found crawling on the bare snow is the true snowfly, which is a crane fly. Their wings are the smallest of knobs and of no value whatever in flying. The legs are hairy, like those of some spiders, but, of course, there are only six legs. These flies will make their way to the surface of the snow when the temperature is down to zero but when the sun is shining brightly. The females appear early in the morning, and, after having mated, make their way again down through the snow, or along plants near the snow, until they reach a place where they may lay their eggs.

On sunny days in February or March the snow around the base of some trees may be pocked with little black specks less than one-fifth-inch long. These may suddenly be hurled into the air, for they are springtails, or snowfleas, among the most primitive of the insects. Their life history is not too well understood.