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THE LIFE HISTORY OF THE HONEY BEE (*APIS MELLIFICA*).*

By Percy H. Selwyn.

Before speaking of the bees themselves it may be well to say a few words in regard to the wax combs on and in which these interesting insects live and move and have their being. When in a wild state the bees are necessarily their own architects and build their combs to suit their own tastes and also to suit the environment of their self-chosen abode—probably in some hollow tree. This results in combs of every size, shape and thickness, and also in an excessive amount of drone comb, which the bees appear to favor as a receptacle for their honey, but which the practical bee-keeper considers most undesirable. The two combs which you now see were taken from an ordinary eight-frame Langstroth hive, which is in general use both in Canada and the United States at the present time. One of these combs consists entirely of "*worker*" comb, while the other is mainly "drone" comb and is the result of the bee-keeper having used a narrow strip of comb foundation in the frame instead of a full sheet.

Since the invention and introduction of artificial comb foundation, which is all stamped with the base of worker cells, the practical bee-keepers of to-day do not consider it either advisable or economical to allow their bees to build their own combs. The reason for this is self-evident when it is known that in order to produce a pound of wax (the amount of foundation required for eight frames) it is necessary for the bees to consume upwards of 20 pounds of honey, which at the ordinary market price would be worth $2.00, whereas a pound of wax foundation costs approximately fifty cents. The combs which

* This is a condensed report of an Address delivered before the Ottawa Field Naturalists' Club, Jan. 21st, 1908.

result from its use are both straight and of even thickness, as well as being all worker comb, a feature which has a most important bearing on the economic side of bee-keeping. Another point in favor of its use is the great saving of time to the bees, and time in their case means honey. If a strong swarm of bees is provided with a hive containing eight frames filled with comb foundation, it is almost certain that within 24 hours they will be found perfectly elaborated or drawn out into cells, so rapidly do the bees work. If on the other hand they are provided with empty frames or frames containing small "starters" of foundation, it is probable that six or seven days at least will elapse before the combs are completed, and during this time a large number of bees are devoting their time and energy to comb building instead of gathering honey.

In this portion of the Dominion owing to the length and severity of the winters, bees have to be safely housed during at least five months of the year, generally from about November 1st to April 1st. During this period of enforced idleness the bees cluster on and between the combs in a more or less oval mass in close proximity to the honey on which they have to feed. Not only do they occupy every bit of space between the combs, but, in order to make the mass more compact, nearly every cell in the area of comb on which the bees are clustering contains a bee, these bees having entered the cells head first. That they do not remain in the cells all winter is obvious as they must come out to feed, but it is presumed that others take their place. The amount of food consumed during the winter varies considerably with the conditions under which the bees are wintered—the colder their winter quarters are, the more honey they will consume. Twenty-five pounds of honey is considered to be a safe amount to carry any hive through the winter and also to provide for the early spring, when little nectar is available in the flowers. It must not be supposed that the bees are in a torpid state during their period of rest, as, though in a quiescent condition, they are very much alive if disturbed. It is of the greatest importance that bees should winter well, that is to say, with a minimum of loss as regards dead bees. Weak colonies in the spring are scarcely worth keeping as honey producers; it is better to take two or three weak hives and unite them, thus making one profitable colony, rather than to allow each of them to gradually dwindle away until they cease to exist, which is the usual fate of weak colonies. After bees are once housed for the winter the less they are disturbed the better, and while they do not appear to notice ordinary sounds the slightest jarring sensation irritates

them and should be carefully guarded against. The conditions necessary for safe wintering are briefly as follows: A dry, frost-proof cellar with a temperature between 38° and 45°, sufficient honey (say 25 pounds), perfect freedom from any shaking or jarring, complete darkness, sufficient ventilation to allow the moisture in the hive to escape, and freedom from rats or mice, which work great havoc with both combs and bees during the winter.

The time when colonies should be removed from their winter quarters depends almost entirely on the weather. If the ground is free or almost free from snow and the temperature fairly warm, the sooner they are placed on their summer stands the better. After such a long period of inactivity many of the bees have lost their full power of flight, and it is therefore advisable to choose a warm still day, with sunshine, on which to give them their liberty. After even one day of exercise the bees are able to take care of themselves and do not leave their hives unless the weather is favorable. If they are given their first flight on a cold windy day, even if the sun is shining brightly, the chances are that hundreds of bees, if not thousands, will fall to the ground and never regain their hives, particularly if rain or snow should follow the next day.

A colony of bees should, in the early spring, consist of a queen and 25 to 30 thousand worker bees. The drones, or male bees, do not usually appear in the hive until the middle or end of May, though they are sometimes found in very strong colonies much earlier. The queen is the mother of the entire colony. Her one and only duty seems to be to lay eggs, and it is said on the best authority that to lay two thousand in twenty-four hours is quite within her power. In shape the queen resembles the workers more than the drones but is longer than either, and like the workers she possesses a sting but will not use it on anything below bee royalty—that is to say, on some other queen. Unlike the workers and drones a mated queen never leaves the hive except with a swarm. The average age of a queen is probably three years, but modern bee-keepers re-queen their colonies oftener as a young queen is usually much more prolific than an old one. The worker bees, as their name implies, perform all the duties of the hive. The average life of the workers during the summer months is probably not more than eight weeks, and often less. It seems as though they actually work themselves to death, as those that are hatched late on in the summer live much longer, in fact through the six months of winter when they have no work to do. The duties of the worker bees from spring to fall are manifold,

they gather the nectar and pollen from the flowers, secrete the wax required in comb building, construct the combs, prepare food for the young larvae, carry large quantities of water, ventilate the hive and guard it against all intruders. Nectar and pollen are gathered simultaneously from the flowers, the former is carried, like water, in a sac or bag in their abdomens and is regurgitated into the cells on their return to the hive. Pollen or "bee-bread" is carried in basket-like cavities on the bees' posterior legs, and is, so to speak, kicked or rubbed off into other cells in close proximity to the larvæ for which it is intended. Propolis or "bee glue" is carried in a similar manner and is obtained from the buds of certain trees like the balm of Gilead, horse-chestnut and others. This sticky substance is used to fill up all cracks and crevices in the hive. Wax is secreted between the rings of the bees' abdomen, on the under side, and is in the form of thin white scales about one-sixteenth of an inch in diameter and somewhat circular in shape. These scales of wax are removed with the claws on the bees' hind legs and conveyed to their mouths and are then applied to the surface where comb building is in progress. The thousands of larvæ in the hive are carefully looked after and fed by the workers during the six days of their larval existence, after which the cells containing them are covered over with a thin and porous capping consisting of a mixture of wax and pollen, thus allowing the air to penetrate to the occupants in the chrysalis stage, which pure wax would not do. Pure wax is however used by the bees in capping their honey because it requires to be impervious to the air.

The drones are unlike the queen or workers, their bodies are large and clumsy and without the symmetry of either. They are quite unable to defend themselves, having no sting, and can consequently be handled with impunity. Their tenure of life is exceedingly uncertain and often terminates very abruptly. Should the condition of the weather be such that the honey flow is suddenly cut off the worker bees may, and probably will, decide to destroy not only all the drones in the hive, but also all the drone larvæ, and when this is done swarming is indefinitely postponed. In ordinary seasons drones in varying numbers will be found in all strong hives from May to about September, though after swarming is over they may be destroyed any day. The final destruction of the drones usually takes place towards the end of August, and it is no uncommon sight to see the worker bees in a dozen different hives in the apiary all persistently chasing the drones and ruthlessly turning them out to die. It is said, and I am inclined to think with some truth, that they actually sting them to death if other means fail.

In the early spring the amount of brood usually found in a hive is comparatively small, but as soon as the bees are placed on their summer stands and the active out-door work is resumed, the queen begins laying with extraordinary rapidity, particularly if the colony is strong. Within a few days, if the weather is warm enough for the bees to work, a wonderful change takes place in the hive. Frame after frame will be found filled with eggs and larvæ in all stages of growth. A square inch of worker comb contains 50 cells, counting both sides, and as there are 126 square inches in the ordinary Langstroth frame, each comb contains 6,300 cells or a total in the eight frames of about 50,000 cells. The cells of drone comb are larger than the worker and a square inch contains only 32 cells counting both sides.

Towards the end of May the hives begin to get crowded with bees, and each day adds many hundreds to their number. When these conditions prevail swarms may soon be expected, and an examination of the hives will reveal the preparations for this important event. Not only will there be a considerable number of drones in the hive but all available drone comb will be filled with eggs and larvæ in all stages of growth, even to the young drones cutting their way out. Queen cells will also be found attached to the bottoms and sides of the frames and occasionally to the surface of the combs where some inequality exists. Some of these cells will be only partly constructed and may contain eggs or still be empty, others will be further advanced, though still uncapped and will contain the queen larvæ literally floating in food which is called "royal jelly" and which looks like thick cream or cornstarch. This food is quite different to that which is given to either the drones or worker larvæ, and it is in consequence of being fed this rich nitrogenous food that a queen is reared instead of a worker, and that her organs of reproduction are fully developed which is not the case with worker bees.

As soon as one or more of the queen cells are capped, probably the next day if the weather is favorable, a swarm may reasonably be expected. Before the swarm issues, the bees, realizing that they are going to seek a new and empty home, fill their honey sacks with honey in order that they may be able to secrete the necessary wax to begin comb building in their new home, and also that they may have sufficient food should the weather be unfavorable for a day or more following their migration. The question is often asked, which bees leave with the first swarm, old or young? My experience leads me to the conclusion that both old and young alike go, and that practically

the only bees left in the hive after the swarm has issued are the very young ones, still silvery-grey and evidently hatched within a few hours. If the hive is examined an hour or two later a number of older bees will be found in it, no doubt those that were out in the field when the swarm issued. These bees look after and feed the thousands of larvæ from one to six days old and are assisted in this work by the hundreds of young bees which are hatching every hour. First swarms accompanied by the old queen usually leave the hive between the hours of 10 a.m. and 3.30 p.m., seldom earlier or later. Second and after swarms are much more uncertain in their habits, and it may almost be said of them that they will leave the hive during any hour when the sun is shining. First swarms always cluster for a time within a reasonable distance of the hive which they have left, but second swarms have frequently been known to go straight away for miles without a preliminary halt.

The first outside indication of a swarm will be an unusual number of bees about the entrance of the hive; not hanging in the listless idle manner they do for several days previously, but all excitement, running in and out of the entrance, flying a short distance only to return until at last the exodus begins in real earnest, and a wonderful sight it is to see those thousands and tens of thousands of insects all filled with the same desire to leave in the utmost haste their well provided home for one which, in the ordinary course of nature is probably as yet unfound and certainly devoid of the necessities of bee life. It is quite commonly supposed that the queen leads out the swarm; this idea is entirely erroneous, as she seldom appears until the swarm has partly issued and often she is amongst the last to leave the hive. As to how or when the new home of a swarm, possibly in a hollow tree, is selected, must always remain a matter of doubt, but it is probable that a suitable place is found by some of the worker bees during the time the swarm is hanging on the bough of some tree, and that these bees return and lead the way to their future abode. In about nine days after the first swarm has issued a second swarm from the same hive may be expected if the weather is favorable and the honey flow abundant. This second swarm will be accompanied by a young or virgin queen, and on the seventh or eighth day if a swarm is going to issue, she can be distinctly heard giving the swarming note which is called "piping," and which resembles the word "zeep" repeated several times in rapid succession at intervals of a few minutes. Her piping will be answered by other young queens which are ready to leave the cells at any time, but which are either afraid to do so,

or are prevented by the worker bees. The sound made by these imprisoned queens is much deeper in tone owing probably to their being covered up in the cells. When the second swarm has left the hive it may be followed within two or three days by a third or even a fourth. These after-swarms are small and worthless, and are frequently accompanied by two or even three virgin queens. Practical bee-keepers of the present day do not consider it advisable to allow even second swarms to issue, because in doing so the parent hive is depleted of bees to such an extent that it is practically useless as a surplus honey producer for the remainder of the season. In order to prevent second and after-swarms the queen cells must be carefully removed three or four days after the first swarm issues, leaving one promising looking cell to provide the necessary queen. This cell must be carefully watched until the royal inmate is safely hatched, otherwise the hive might remain queenless. If the queen cells are all but one removed as early as the third or fourth day, the bees may, and probably will begin others, so careful are they not to trust the fate of the hive to one cell which may or may not produce a perfect queen. In order to do this they have to turn worker cells, containing larvæ not more than two or three days old, into queen cells and provide the inmates with "royal jelly" to feed on, instead of the ordinary liquid food necessary for the worker larvæ, in order that they may now become fully developed females. If this second supply of queen cells is started they must be destroyed as soon as there is a queen in the hive, otherwise all the precaution taken may be of no avail and a second swarm will issue when least expected.

When the season is unfavourable the bees themselves decide that there will be no second or after-swarms and when this is the case they allow the first young queen which hatches to destroy all other queen cells. This she soon does by tearing out the sides of each one with her powerful mandibles and stinging the inmates to death. If several queens have already hatched there is a battle royal and the "survival of the fittest." The young queen leaves the hive to mate with the drone about the fifth or sixth day after hatching, but several days frequently elapse before this takes place. After mating she returns to the hive and does not leave it again until she issues with a swarm, probably the following spring.

A newly mated queen usually begins laying within a day or two, and rapidly fills the now almost empty combs with eggs. If no second swarm has issued the parent hive will, if the season is favorable, give a considerable yield of surplus honey, and by

the end of August it will have fully regained its normal strength. From that time onward the queen will gradually contract the space occupied by brood, and after the young bees hatch in the outer frames, the cells are left unoccupied or are filled with Autumn honey. Just as the space occupied by brood is enlarged in the Spring by the queen from the centre outwards, so it is contracted from the outside to the centre as the Autumn draws near. This contraction is necessary because in September, though the days may still be warm, the nights are liable to be cold and frosty, thus causing the bees to cluster in a compact mass, as during the winter, for the sake of warmth, and brood in the outer combs if left uncovered by bees would certainly perish. Before the autumn is too far advanced it is always advisable for the beekeeper to make sure that none of his colonies have become queenless, or are in even a worse condition, viz., that of having a drone laying queen; and also to make equally sure that they have sufficient honey to carry the bees safely through the long winter. When a virgin queen leaves the hive for the purpose of mating, she sometimes fails to return and such colonies must be promptly provided with another queen, otherwise they will soon dwindle away and become a prey to the bees worst enemy, the larvae or grubs of the bee-moth (*Galleria mellanotis*.)

Under normal conditions bees will always provide themselves with a new queen when necessary, but in order that they may be able to do this successfully there must be either worker eggs or very young worker larvae in the hive and a fair number of drones still in the apiary. When the season is far advanced and the drones have all or nearly all disappeared, this method of re-queening with a virgin queen cannot be recommended, owing to the uncertainty of her finding a mate. If the colony is worth saving it will be better to purchase a mated queen from some reliable dealer, rather than trust to chance. When a virgin queen fails to mate within a few weeks after hatching, she becomes what is known as a drone layer—eggs laid by such a queen are deposited in a most irregular manner, sometimes two, three or even more in one cell. Another peculiarity is that while these eggs produce *only* drones they are usually deposited in worker cells instead of drone, with the result that the inmates when hatched are little more than half their normal size owing to not having had sufficient room to attain their full growth.

A colony which has been in possession of a drone laying queen for three or four weeks is in a sad plight and certainly not worth trying to save as it will probably contain only a few hundred bees and a varying number of dwarfed and useless drones.

THE HONEY BEE AND OTHER BEES.

By James Fletcher, Dominion Entomologist.

At the conclusion of Mr. Selwyn's lecture upon the life and work of the Honey Bee, Dr. Fletcher spoke at some length on the points brought out by the lecturer, emphasizing what had been said with reference to the remarkable social and communistic habits of these insects, and drawing special attention to the many homologous characters common to them and human beings. As with some men, the drones made a good deal of noise, fussed a good deal, ate a good deal, and knew how to stay where it was comfortable. The hard working females on the other hand spent their whole lives in keeping the house in order, in feeding the young and the almost worthless drones, and in laying up a store of food to sustain the colony through the winter.

They illustrated every virtue we are taught to admire in mankind, industry, providence, love of home, and loyalty; even to the extent not only of feeding their queen from the time she hatched from the egg and throughout her whole life, but they went so far as to keep her in order and make her do what was good for her, sometimes against her own will.

The speaker said:—

Every incident in the life of a colony of bees has been so fully treated of by Mr. Selwyn that it is unnecessary to add anything further on that subject. The Honey Bee is not a native of North America, but was certainly introduced very early in the settlement of the country. The colonies of wild Honey Bees which are sometimes seen in the woods, have merely originated from swarms which left apiaries in the vicinity and then established themselves in some convenient hollow tree. There are, however, many kinds of wild bees in Canada which are well worthy of study by naturalists; but none of which produce honey of commercial value. Some of the Bumble Bees do, it is true, store up a certain amount of honey in their underground nests, as is well known to all school-boys, and this is of a very rich aromatic flavor; but unfortunately this honey is small in quantity, and moreover has the unpleasant effect of producing intense headache in the case of many people who eat it.

The Bees belong to a very large order of insects known as the Hymenoptera or membrane-winged insects. When wings are present there are two pairs, with but few veins and having the upper and lower wings on each side held together in flight by means of a series of hooks.

The mouth parts are constructed both for biting and for sucking, the tongue often being developed into a long organ for lapping up nectar and other liquids. The mandibles of the honey bee form useful little trowels by means of which the wax is shaped into cells. The ovipositor of the females in the Hymenoptera is remarkably modified according to its required uses. Among the Ichneumon flies it is sometimes enormously developed for placing the egg where the young grub will find its food on hatching. In the genus *Thalessa*, two species of which are not uncommon at Ottawa, these egg-laying organs are upwards of three inches in length and can be driven down through as many inches of solid maple wood. Among the saw-flies this organ is modified into a pair of saws, by means of which the eggs are inserted into the tissues of leaves or of stems; and, then again, among the bees and ants, as a sting it becomes a weapon of defense and the eggs are passed out close to the base instead of through the tip.

It is not quite known what all the purposes are of the poison injected by the stings of Hymenoptera. It is supposed that it is of an antiseptic nature, and that a small quantity is introduced by bees into honey before sealing up the cells, which has the effect of preserving the honey from decay. It is interesting to note that the stingless bees of the genus *Melipona* make honey, but that this honey will not keep. Among several of the Solitary wasps, the sting becomes a very important instrument; for by its means the food of the young, which consists entirely of other insects, is paralyzed, and it has been found that the venom of bees and wasps is chemically almost identical in composition with chloroform; consequently, caterpillars or other insects stored away as food for the young wasps, after having been stung, remain alive and fresh, but perfectly senseless, for a long time. I have sometimes taken caterpillars from sand wasps which had stung them and were dragging them away to their nests, and these have remained almost without motion, but evidently alive, for many days; they have even, in one or two rare instances, gradually recovered so as to be able to crawl away.

The stings, then, of wasps and bees, it may be remembered are provided for useful purposes and not for stinging careless and thoughtless people. There is no doubt that bees are much

more aggressive to some people than to others; but, as all bee-masters know, it is very seldom that they will sting if certain precautions are taken. When moving about among the hives you should never stand immediately in front of a hive, nor hit at the bees when they circle round your head. Occasionally, however, it may be necessary to kill a very persistent or irritated bee. You can generally tell by the note emitted when a bee is angry; but anger among bees, as with human beings, must always be regarded with pity, particularly so in the case of bees, because their excitement is only over-zeal in protecting the home against a supposed enemy. The sting itself is a rather complicated organ consisting of barb-tipped darts which run down through a sheath and are controlled by levers. The venom is produced in a poison-gland and is stored in a special sac till required. Morphologically, the sting is composed of six separate parts. When a bee stings, the sting remains in the wound by reason of the barbs and the insect soon dies from the mutilation. In this bees differ from wasps, which have smoother stings and can use them repeatedly. The changes in the different stages of the Hymenoptera are what is known as "complete," that is, the larva is very or *completely* different from the pupa, and the pupa from the perfect insect, and, notwithstanding that these insects show to the greatest degree what we call intelligence and live the most specialized or highest kind of life, the young are more helpless and dependent on their parents for food and safety than in any other class of insects. With the Solitary wasps and bees a supply of food is stored in the cell with the egg, so that the young grub on hatching finds all it requires close at hand. With the Social wasps and bees, and all the ants, the workers feed the young all the time until they are full grown.

The Hymenoptera constitute an enormous order embracing in North America upwards of 8,000 species and include insects of most diverse habits and structure. Bees, wasps and ants are among the best known representatives of the order; but here we also find the large and important families of parasitic ichneumon flies, the small but most useful Chalcids and also many gall flies and sawflies.

A point of some interest to those who do not study insects, is the difference between wasps and bees. In general appearance these may, as a rule, be readily distinguished; but their habits are also quite different. All bees feed upon nectar and pollen, while wasps feed upon animal food, particularly other insects. They are also, it is true, very fond of sweet substances, such as the juice of fruits, and will even steal honey from bees;

but this food must be considered as exceptional. The young are probably fed entirely upon animal matter. As a typical example of wasps, there is no better than the large black and white species so common here, which builds the large oval paper nests which may be often seen hanging to trees, shrubs and sheds, and which are generally spoken of in this country under the name of "Hornets." The true Hornet, however, is a very large and exceedingly venomous tawny species found in Europe, and which, strange to say, has in some way been imported into the State of New Jersey, where Prof. J. B. Smith tells me that in some places it is not uncommon. Even in the case of wasps which are useful insects which destroy many injurious species, the sting is not produced on all occasions and without provocation. Unless molested or when their nests are interfered with, our wasps and, even the formidable European hornet, will seldom sting. It is claimed by one of our members that even when by accident he had broken down the nest of a colony of wasps, by standing perfectly still until the insects had settled down, and then moving away very quietly, he has escaped without a single sting. It must be acknowledged, however, that it requires a good deal of coolness and pluck to carry out such a programme. The Social wasps live in colonies similar in many ways to those of the honey bee, consisting of males, females and workers. The winter, however, is passed by the queens or impregnated females only, all the males and workers dying before winter. In the spring each female starts a new nest, and all of the first young produced are workers, who soon build up a new colony. Perfect males and females appear towards winter. Wasps, as a class of insects, are divided into first, the *True Wasps* which have the fore wings folded lengthwise when not in use. Here we find not only the large black and white wasp mentioned, but also the Yellow-jackets, which are social in habit, and a large number of solitary wasps, in which only males and females are developed; and secondly, the *Diggers*, which are always solitary, including the Carpenter, Mining, Digging and Mason wasps.

All bees belong to a super-family known as the *Apoidea*, in which we find social or solitary species with the tongue long or short, and the hind legs or the under side of their bodies furnished with brushes for carrying pollen. Bees of all kinds are very beneficial from the good work they do in cross-fertilizing the flowers of fruit and other trees while visiting them to gather nectar or pollen. The two most conspicuous divisions of the bees are the Honey Bees and the Bumble Bees. These latter are social in their habits in a similar way to the Wasps,

in that it is only the perfect females which pass over the winter, and in the spring each of these starts a new colony. Their nests are for the most part rather clumsy, untidy structures, the cells being irregular in shape and formed in a mass of pollen and honey. Owing to the length of their tongues, Bumble Bees are useful in pollenizing clover and were actually imported into New Zealand for this very purpose some years ago. Closely resembling the Bumble Bees are some species of *Apathus*, which live in the same nests with them, but are parasites or at any rate do not help in the work of the colony, and the females have no collecting baskets on their legs for carrying pollen. The large Carpenter Bee of Western Ontario, *Xylocopa virginica*, which somewhat resembles a Bumble Bee, makes tunnels half an inch in diameter and several inches long into the solid wood of sheds, houses and other buildings.

Very interesting insects are the Leaf-cutter Bees, (*Megachile*) which make their nests of several cells each one from half an inch to three-quarters of an inch in length, and neatly incased in round pieces cut from the leaves of roses, maples and other trees. Each of these cells contains a single egg and a mass of "bee-bread", pollen and honey, sufficient to feed the young larva to full growth. A small group of bees known as the Nomads are parasitic in the nests of other bees.

The large group of *Andrenidæ* consists of short-tongued bees which dig out galleries beneath the surface of the ground. Some are solitary, as in the case of the true Andrenas, in which a single burrow may have four or five cells made by one female; or there may be large colonies, as in the genus *Halictus*, in which many females use the same common main shaft; but each has her own little gallery running off from this.

The Hymenoptera present so many features of extreme interest, and they are of such importance in their rôle of parasites as the main controllers of the undue increase of injurious insects, that the special study of any one of the groups would provide a life work of the greatest fascination to anyone who would devote time to it. I feel sure that all who have listened to Mr. Selwyn to-night must be convinced that a study of any of these insects would well repay them.

BOTANICAL NOTES.

RIBES RUBRUM, L.

Mr. M. L. Fernald in *Rhodora* vol. IX, pp. 1-5 separates the species that have been referred to *R. rubrum*. There are two cultivated species of red currant, the one, *R. rubrum*, has the calyx somewhat cup-shaped, brown or mottled with red and destitute of a disk, the other, *R. vulgare*, Lam., has a flat, yellowish green calyx and bears a prominent disk. The latter is the common species of cultivation. Mr. Fernald does not know of the occurrence of *R. rubrum* in a wild state in America and all our specimens are plainly referable to *R. vulgare*. Of the indigenous wild currant Mr. Fernald recognizes two varieties, *R. triste*, Pall., and *R. triste* var. *albinervium* (Mx.) Fernald. The latter has the leaves sparingly pubescent beneath when young, soon glabrate, and is by far the most common red currant in Canada, ranging from Nova Scotia to Alaska. *R. triste* is permanently white tomentose beneath, and though its range is stated by Mr. Fernald to be "Newfoundland to Alaska," it has been seldom collected in Canada, and when the habitat is given it has always been where the rock of the vicinity is calcareous.

PRIMULA FARINOSA, L.

Mr. Fernald separates this widely distributed species into *P. farinosa* and three varieties—*Americana*, *macropoda* and *incana*. Typical specimens of all four are found among the large series of Canadian specimens in our herbarium, but intermediate forms also occur, especially in the west. As shown by our specimens, *P. farinosa* is confined to Labrador and Newfoundland, *Americana* to the vicinity of the Great Lakes, and *incana* to the Rocky Mountains and western Alberta, while *macropoda* ranges from Labrador to the Mackenzie River. In the west it is sometimes difficult to decide whether flowering specimens should be called *incana* or *macropoda* but *incana* is the characteristic plant of the foot-hills and *macropoda* of the prairies. *Americana* as described by Mr. Fernald, however, might well be considered a species, its very short bracts and calyx separating it from *macropoda* and *incana* and the *sulphur-yellow* powder of the under surface of the leaves from *P. farinosa*. Our specimens of *Americana* are from Johnstone's Harbour, Lake Huron and from Lake Superior, the latter specimens collected by Prof. Macoun, July 16th, 1869. We have also very characteristic specimens from Michigan.

J. M. M.

REPORTS OF SOIREES.

There is no part of the work of the Field Naturalists' Club upon which more care is bestowed than on the preparation of the programme of winter lectures, and it is doubtful whether in the history of the Club there has been a better programme than that offered for 1907–8. It is through its lectures and informal talks that the Club comes most directly in touch with the public as the audiences are made up in great part of those who while not members of the Club are specially interested in and attracted by the subjects upon which addresses are given. The opening evening is always made as attractive as possible and this year short talks were given on "Personal Experiences in the Field during the past season" by five of the Club's oldest members,in the Assembly Room of the Normal School, December 10th. Dr. J. F. White the Principal of the Normal School in a short address of welcome complimented the Club on the good work it was doing and assured its members of the hearty co-operation of himself and his staff in this work. He was followed by Dr. S. B. Sinclair whose "personal experience" described a fire which had been neglected near where he had spent the summer in the Parry Sound district and which after it had spread until it seemed to be beyond control was systematically and heroically attacked by himself and seven neighbors and after five days work was stamped out, although everything was as dry as tinder and the wind blew almost continually. He learned there that fire usually travels very slowly, if at all, during the night and that sand extinguishes fire as effectively as water and is usually much more easily obtainable. A full report of Dr. Sinclair's address, which was illustrated by several beautiful lantern slides, will be published in the March number of *The Canadian Forestry Journal*.

Dr. Fletcher who can carry his audience with him to whatever place he may be describing and make them see not only the place but what he saw when there, took them to the tops of some of the highest mountains in British Columbia and told them of the elusive butterflies and other insects he had seen and captured there. Veritable "Mountain Sprites", only to see them in their wind-swept homes amply repaid the enthusiast who went in search of them. His address in a condensed form will be published in the March number of THE OTTAWA NATURALIST.

Although Dr. Ami had spent a considerable part of the past season in field work he also represented the Geological Survey of Canada at the Centenary of the Geological Society of London, and by special request told of the meeting in London and some of his experiences there. What impressed him most was the appreciation shown by European geologists for the work of Canadians and the high estimation in which Canadian geologists are held by their confreres in England. No effort was spared to make the meeting a success socially as well as scientifically, the only drawback being that there was more to be seen and heard and done than there was time for.

A condensed report of Mr. F. T. Shutt's address on "Rain and Snow" was published in the December number of THE OTTAWA NATURALIST and a synopsis of Mr. A. Halkett's "Observations in the Provinces of Alberta and Saskatchewan" will be found in the "Report of the Zoological Branch" published last month.

As is usual at the opening meeting there was an exhibition of specimens which included representatives of all branches of Natural History.

Dr. Bryce always has something of value to tell his audience and always tells it in an interesting manner, but it is not often that a lecturer addresses a more attentive audience than listened to him at the Carnegie Library, January 7th, when he lectured under the auspices of the Club on "Some Sanitary Considerations in the Construction, Heating and Ventilation of Dwellings." As Dr. Bryce's lecture will be published in THE OTTAWA NATURALIST at an early date no report of it need be given here. The Report of the Zoological Branch which has already been published was read at this meeting.

J. M. M.

MEETING OF THE BOTANICAL BRANCH.

The third meeting of the Botanical Branch was held at the home of Mr. A. E. Attwood January 18th. The members present were Messrs. Fletcher, Harrington, Cameron, Blackader, Campbell, Carter, Whyte, W. T. Macoun and J. M. Macoun. Mr. Attwood as a subject for discussion read the botanical part of a draft programme for Nature Study work in the lower grades of the Public Schools, now in course of preparation. He explained that his object in reading this tentative programme

was to secure from those present their opinions as to the best methods to pursue. Nature Study work will begin as soon as a child leaves the kindergarten and enters the Public School proper, and it was important that at the very beginning instruction should be on lines that would be followed as the child advanced from grade to grade. A great variety of opinions was expressed by those present, some being of the opinion that all Nature Study teaching should have a practical side, while others considered its more important function to be the training and development of the child's natural powers of observation without special attention being paid to the practical application of what was taught. There was a difference of opinion, also, as to whether Nature Study should not form part of the Natural Science Course, one or two thinking that the two should be kept quite distinct, the Nature Study work being kept as non-technical as possible; but the general feeling was that while all Nature Study work was not scientific, all Natural Science studies were really part of Nature Study as it should be taught in the schools. Lists of the best seeds of flowers, trees and shrubs to be used for illustrating the mysteries of germination; lists of shrubs and trees from which the buds most suitable for Nature Study instruction could be procured and lists of plants to be studied in the Spring and Autumn were submitted and discussed.

J. M. M.

COUNCIL MEETING.

A meeting of the Council was held on January 6th in the Normal School with the President, Mr. W. J. Wilson, in the chair. Members present were: Messrs. A. E. Attwood, A. H. Gallup, J. W. Baldwin, A. Gibson, E. E. Lemieux, and T. E. Clarke; Miss Q. Jackson and Miss A. L. Matthews.

The following were elected ordinary members: Messrs. Hiram Robinson, Morley E. Wilson, and J. P. Finn, B.A.

The President informed the Council that the room in the Normal School which the Club had been privileged to use as a library would no longer be available since it had been found necessary to make use of it for school purposes. A committee consisting of Dr. Jas. Fletcher, Dr. H. M. Ami and Mr. A. H. Gallup was appointed to see if a suitable room could be secured elsewhere.

REVIEWS.

Alpine Flora of the Canadian Rocky Mountains, by Stewardson Brown. Illustrated with 31 water-color drawings and 91 other illustrations by Mrs. Charles Schaeffer, pp. 352. Putnam's Sons, New York. $3.00.

Contributions to a Catalogue of the Flora of the Canadian Rocky Mountains and the Selkirk Range, by Edith M. Farr. Contr. from the Bot. Lab. of the Univ. of Penn. Vol. III. pp. 1-88. Bot. Dept., Univ. of Penn. $1.00.

Among those who visit the Canadian mountains the greater number perhaps go chiefly to revel in the unrivalled scenery of the Rockies and Selkirks or to climb the peaks that tempt them on every hand. But there are few who can spend even one day in the mountains without feeling the desire to know at least the common names of some of the beautiful wild flowers that fill the woods and meadows and cover the mountain slopes with masses of brilliant color. Mrs. Henshaw's "Mountain Wild Flowers of Canada"* will long remain the "popular guide to the names and descriptions of the flowers that bloom above the clouds." Written by a good botanist and one who is an ardent lover of flowers it appeals to the Nature lover in a way that no "Flora" or "Catalogue" can do, and Mrs. Henshaw seems always to have found the exact word to describe the characteristic beauty of the plant she may be writing about, a matter of greater difficulty than is realized by one who has not attempted it.

While Prof. Brown's book is very far from being a complete "Flora" of the Rocky Mountains it is strictly "scientific" as far as it goes, and the amateur botanist who so dearly loves to "analyse "and "classify" the plants he collects will find that he can with this book identify all the commoner species at least, that he will find in the Rockies or Selkirks, for though the title covers only the Rocky Mountains the matter includes the Selkirks as well. The average tourist, however, will prefer Mrs. Henshaw's simpler, if not very scientific, arrangement of the alpine flowers in groups according to their color, as by this means he can in a very short time learn the names of the plants he has collected. Beginning with a general key to the families, Prof. Brown gives briefly and clearly the characters of each family and of the genera into which they are divided. The number of species in each genus is as a rule so small that the characters separating these are not given in the form of a key but will be found in the descriptions of the species themselves. These descriptions are with very few exceptions accurate and not unnecessarily long. The habitat of each species is also given

* Reviewed in the Ottawa Naturalist, Vol. XX, p. 114.

and its distribution in a general way. Had one or two localities been mentioned at which collectors could find each species, the value of the "Flora" to the traveller making only a short stay in the mountains would have been greatly enchanced, but as this defect is covered by Miss Farr's "Catalogue" which is a natural, and indeed a necessary complement of the "Flora" it will not be felt to the degree it would have been had the "Catalogue" not been published. The names used by Dr. Brown are those approved by the school of American botanists who have not accepted the "Vienna Rules." No objection could be taken to the use of this system of nomenclature were any synonymy given but one not familiar with some of these new names will be unable to decide whether they are applied to new segregates or are only new names substituted for the old familiar ones, which will generally prove to be the case. This defect is also remedied, however, by Miss Farr's "Catalogue." In her preface she says candidly: "The nomenclature is in accordance with the best judgment of the author," but "one synonym is given under each species where from familiar usage in the past such a course seems desirable." A strict application of the "Vienna Rules" will result in the changing of very few of Mrs. Henshaw's names and fewer still of Miss Farr's.

Of Mrs. Schaeffer's illustrations nothing but praise can be said or written. If a very few of the colored illustrations are a little "off color" the fault lies in the difficulty of reproducing in color the delicate shades so characteristic of many alpine flowers, and Mrs. Schaeffer's illustrations are much the best the writer knows of in any American work of this kind, and there is not one of them that would not serve to identify immediately the species it is intended to represent. The half-tones are also excellent and the reproduction on the same plate of an inch measure makes it easy to determine the relative height of the plants reproduced. A comparison is naturally suggested between Mrs. Henshaw's book and that of Dr. Brown and Mrs. Schaeffer, but such a comparison cannot be made. Each is excellent in its own way. Some will prefer one and some the other but the qualities that make both good, and each in some respects better than the other, are so diverse that no one with the smallest interest in or love for flowers can visit the Canadian mountains and afford to be without either. The publication of two such books is of vastly greater significance than may appear to the unthinking. They will serve to advertise our mountains and attract visitors not only from the United States but from Europe, and what the average Canadian may not know is that though transportation companies, hotel-keepers and even the

Government have for many years exploited the mountains of the Western States no such books as either of these have been published on the flora of these mountains, a fact sufficient in itself to show that they do not offer the attraction to the tourist and Nature lover that our Canadian mountains do. These books and the work of the Canadian Alpine Club will do more to attract strangers to our mountains during the next five years than anything else will. It is to the credit of the Canadian Government and the Canadian Pacific Railway Company that this is not only appreciated by them but that their appreciation has been shown in a practical way by affording every possible assistance to the authors of these books and to the officers of the Alpine Club in the prosecution of their work.

Miss Farr's "Catalogue," as has already been said, is the natural complement of both of the books referred to above. But it is something more than a Catalogue. Like Macoun's "Catalogue of Canadian Plants" which gives the general distribution of all the species of flowering plants which were known to occur in Canada at the time of its publication and also the particular localities at which rare species had been collected, Miss Farr mentions a locality in either the Rockies or Selkirks, or both, at which each species may be found, which makes it possible for one who has only a part of one season to spend in the mountains to collect most of the species known to occur there. The "Catalogue" is also a practically complete list of the plants of those parts of the Rockies and Selkirks that it covers. Based on her own collections in 1904 and 1905 Miss Farr has added to her own list all species reported by other collectors. That a *complete* list of the plants of any region should be published is of course out of the question. All that anyone can do is to publish a list of the plants *known* to occur and this Miss Farr has done. Botanists like Prof. Macoun and Dr. Fletcher who have collected in the Rockies and Selkirks for more than twenty years could add a good many names to even Miss Farr's list, but these names have not been published, and indeed some of the plants collected by them are listed for the first time in Miss Farr's "Catalogue." To the professional botanist the "Catalogue" will prove more valuable than either the "Flora" or Mrs. Henshaw's book. The amateur botanist and the casual visitor to the mountains will find it an absolute necessity, for they will certainly find many species that neither Mrs. Henshaw nor Dr. Brown has described, but which are catalogued by Miss Farr.

J. M. M.

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