

cocoons escaped, from which, in a few days, emerged large and magnificent moths. From the two first couples I obtained two pairings; the other moths were all females.

The couples were placed in small separate cages, and in the open air, under a roof. The first male and female moths, born in the evening, the 6th of July, paired in the night of the 7th, the pairing lasting 42 hours. The pairing of the second couple, which took place the following night, lasted 48 hours. I never had any species of moths the pairing of which lasted so long. I was so anxious about the success of my first experiment with this species that I paid a visit to the first couple in the middle of the night, when I was agreeably surprised to see that success had been obtained, and that in spite of the rather unfavorable weather.

I was afraid of failure after reading a description of *mylitta* in vol. xxxii. of the "Naturalist's Library," edited by Sir William Jardine, in which the writer of the memoir on *mylitta* says that this species cannot be domesticated. This evidently refers to a race of *mylitta* with habits very different to those of the Himalaya race, as it is further stated "this species cannot be confined, for, as soon as the moth pierces the cocoon, it gets away, and the people add that it is impossible to keep it by any precaution whatever." In another part of the memoir, the following extraordinary statement is made: "I have frequently endeavored to detain the males of the Jarroo species, and have kept them locked up in a box for that purpose; but, whether they did not like to make free with their female relations, or from what other cause I know not, but I never could obtain a breed in the domestic state; and the efforts of the male to escape were wonderful, and, at last, always effectual." The Jarroo species alluded to is that from which the cocoons are obtained during the coldest month of the year—January.

Although I could not take the above statements in a literal sense, I feared it was impossible, or at least difficult, to cause the *mylitta* moths to pair in captivity. Fortunately, the moths of this great and valuable species paired readily, and for a considerable time (a most important thing), and the females laid their eggs for several days without even damaging their wings. Contrary to some small species of *mylitta*, which are restless, the moths of this large race were extremely quiet; they could be taken by the hand and placed anywhere without letting themselves fall. The male moths must have been as quiet as the female, as they were, after the pairings had taken place, as fresh as they were after emerging from the cocoons.

The two female *mylitta* laid about 450 ova altogether. These eggs are of a whitish color, round, rather compressed, generally with two lines encircling them; they are somewhat larger than the eggs of *Yama-mai* and *Pernyi*. Some of the ova are smaller than the others, and very likely they produce the male larvæ.

The hatching of the ova commenced on the second of August. The smaller larvæ, in the first stage and when just hatched, were light-brown or buff, the larger ones of a greenish tint. In a few days they all became of a more uniform color. Round each segment there is a black line. The head and legs of the larvæ are black, and there are black spots on the body.

The second stage commenced on the 10th of August. The larva was then yellow-green; no black lines round the segments: the head and legs, as in the first stage, black or blackish brown; black spots as before.

The third stage commenced on the 17th of August. Larva fine green; head and legs, as before, black. Dark spines, with base of a brilliant metallic copper color.

The fourth stage commenced on the 29th of August. From that date, I regret to say, I was obliged to discontinue my rough descriptions of the larvæ, which, up to that time, after thriving admirably without a single fatality, commenced to die, two, three, or more every day, till all were gone within about twelve days—about sixty worms in all. They were fed on oak.

The death of the *mylitta* larvæ I attribute to several causes. The cold weather compelled me to rear them in a room, and I kept them too long under bell-glasses; perhaps they had not a sufficient amount of fresh air, although the large glasses were raised to renew it. After the first stage, it would have been best to rear them entirely uncovered, on oak branches plunged in water, as they did not much wander then. I rear successfully many species under glass, but some of the larger species do best uncovered, with a free ventilation, and better still in the open air.

I feed my larvæ like *Yama-mai* and *Pernyi*, with hard leaves on old oak branches, and, from what I subsequently learnt from Herr Huesmann, it would seem they prefer young and tender leaves, such as those produced by suckers or shoots of the year; but experience alone will teach us the best method of rearing this valuable species. My impression now is that, the foliage being too hard, the worms could not eat sufficiently, and that they were gradually starved.

Mr. P. H. Gosse, writing to me on September 13, 1879, says: "My two *mylitta* larvæ are about $3\frac{1}{2}$ in. in length and $\frac{1}{4}$ in. in depth. Fine apple green, with a yellow line on each side; upper tubercles, burnished copper; middle and lower tubercles, purple; spiracles, orange; face, dark brown. I have fed them, as many others, on horn-beam (a valuable discovery of mine)."

In a subsequent communication, dated September 30, 1879, which Mr. Gosse was kind enough to send me, he says, "In reply to your questions, the *mylitta* larvæ I described in the fifth stage, when full grown. Both have since died. Fatality has attended almost all my species (*Pyri*, *Cecropia*, *Promethea*, *Cynthia*, *Selene*) except *Hyperchiria io*, which has done very well."

Major G. Coussmaker, in his "Memoir on *Mylytta*," published in 1873, says the larvæ moult five times. From this we must conclude that Mr. Gosse's larvæ were in the last stage but one. Two larvæ I received from Herr Huesmann, on the 29th of October, in the sixth and last stage, were of an enormous size.

Lord Walsingham, to whom I sent them for preservation, kindly wrote to me on October 31: "I am much obliged for the two larvæ of *mylitta*. I am sorry to say that I have failed to preserve them satisfactorily, their brilliant pale-green color being quite impossible to retain, and their size rendering them very difficult subjects."

The larva in its sixth stage was this: On the back, 18 brilliant copper tubercles, and two rows of small purple spines on each side; a yellow, lateral stripe on each side; head, dark brown.

Major Coussmaker, in the description of his *mylitta* larva says that, "when hatched, it is blackish-brown, with a shining black head, and that, as it increases in size, the color of the body turns yellow. After the first moult, the head becomes of a blood-red color; the color of the body is of a greenish tint, and after each moult it becomes greener." Major Coussmaker adds, "When full-grown, a fine specimen is, at least, 7 in. long and 1 in. in diameter. I have

weighed one of these dimensions when 45 days old, and found it to be 371 grains."

From what has been said, it will be seen that the rearing of *mylitta* last year was of very long duration, from the beginning of August till the end of October; therefore, in England, and other northern countries, artificial heat will be required to bring the larvæ to the formation of their cocoons. No success could be obtained in the open air.

But in southern European countries, such as Spain, for instance, where the *Yama-mai* and *Pernyi* oak silk-worms are already thoroughly acclimatized and reared in immense quantities, it is to be hoped the *mylitta* will be equally successful.

In August last, I received a letter, dated 27th of July, 1879, from Major Coussmaker, from which I shall quote the following passage: "My system of rearing is very simple and methodical. I keep all my seed-cocoons in a basket, with the pedicels uppermost. At intervals, between 6 and 11 P.M., I look at them, and if I see any moist at the top, I tie them on to a branch of any tree or shrub in my garden, and at daylight I find that the females are paired in the vicinity of their cocoons, while the males have gone away to seek for mates.

"They are left in that condition all day, and at sunset, or when I am going out for a walk, I take the females, let the males fly, and put the females to lay their eggs. The next morning I take the eggs away, and put them into a small box or something of the kind, safe from rats, mice, and ants.

"In nine days they hatch out, and I put them on to shrubs over which I put screens of split bamboo. As the worms grow, they eat the shrubs quite bare, while I move the screens as necessary. To facilitate this moving, I have planted my shrubs in hedges, and now it is only a matter of the food and number of worms.

"From a month to six weeks, according to the moisture and luxuriance of the foliage, the worms take to make their cocoons, and, as far as I can see, success seems certain. The plants I use are the varieties of *Lagerstromia*, *Zizyphus*, *Terminalia*, and *Cassia*. I am not aware as to whether any of these trees can be obtained in England, or whether the worms will hatch out there. The moths paired and laid eggs in 1874, but did not hatch. I hope that you will be more successful."

To conclude, I will now quote a few short passages from Herr Huesmann's letters to me: October 15, 1879—"My *mylitta* larvæ are doing very well, but are growing very slowly; up to this day, only four have formed their cocoons, but these are fully as large as the imported ones. Please to consider that my *mylitta* larvæ are exactly the same age as my *selene*, which partly are moths to-day." October 22—"The first *mylitta* larvæ hatched on July the 31st and commenced to spin on October the 2d, about half of this long time having been spent in the last stage. I never bred *mylitta* larvæ before, but have seen them reared in Bremen two years ago. The larvæ I saw in Bremen were a good deal smaller than mine, and their cocoons, of which I had some in my possession afterwards, produced very small and mean-looking moths. I fed my larvæ on the common oak, but always picked out young sprigs with large and succulent leaves."

At the end of October the larvæ had not all formed their cocoons.—*Journal of the Society of Arts*.

RULES FOR THE MANAGEMENT OF LAYING HENS.

By DR. A. M. DICKIE.

A FEW simple rules applied to the management of laying hens will insure a full supply of eggs throughout the year. But the small number of rules and their simplicity make it imperative that they be understood and applied. A long essay might be written on each topic embraced in the subject, but I will limit myself to as condensed a statement as will cover the ground, and still be plain enough for any one to understand.

No one, so far as I have observed, has succeeded in any business undertaking without giving it a share of his time and attention proportionate to its importance. This is as true in reference to egg-production as in any other kind of business. Hens require some care and attention. Unless their owner is willing to see to his hens he had better not have them.

Hens must have comfortable and convenient quarters in winter. Most people keep too many hens for the accommodation they furnish them. Hens are naturally active animals, and when confined in winter quarters require plenty of room. Fifty hens and four cocks, of all ordinary breeds, should have a house 24 by 16 feet in the clear, and 10 feet high in the clear. This will allow about 70 cubic feet of space for each fowl, which is little enough. No class of animals is so susceptible to the ill effects of crowding as the feathered class. Hens will not lay when too much crowded, nor will they remain healthy long if too many are kept together. The building should be well ventilated without admitting any gusts or draughts of wind. It should face the south if possible and have several windows in front. Where the weather gets very cold it will be well to have the whole front glazed and have a stove inside. Hens cannot lay unless they are kept comfortable, and when the temperature falls to 12° or lower they require a little artificial heat. This heat must be carefully managed; a little fire only should be kept, and it should be as steady as possible. Uniformity of temperature is what is wanted. The houses must be kept clean and neat. The floors should be swept every day, and be dusted over with dry earth, ashes, chaff, short straw, or litter of any kind that can be easily removed. Every hen house should have plenty of suitable roosts. There should be a shallow box or bin in one corner—a sunny corner is best—containing dry earth, ashes, dry chip dirt, or a mixture of them for the hens to wallow in; they enjoy their bath in winter as much as in summer. Where oyster shells cannot be easily procured there should be a box containing gravel within reach of the fowls. A sufficient number of nest boxes with glass nest eggs in them, several shallow vessels for water and feed trough will complete the necessary outfit for the hen house. A very important adjunct to the hen house is an open shed where the fowls can stay at pleasure when the weather is not too cold. Such a shed should protect the hens from the prevailing winds.

When the house with all the necessary fixtures is ready for the stock, the next consideration is to have the right breed. Almost any breed will do tolerably well with proper usage; but there is a great difference in the laying qualities of fowls. Under the same conditions some breeds will lay twice or thrice as many eggs in a given time as others. As a

rule the smaller breeds are the best layers; and of the smaller breeds the Leghorns are preferable for various reasons; they lay a full medium sized egg, are enormous layers, are docile and easily restrained, and have a yellow skin. Of the large breeds the Brahmas are the best layers. A cross of a Leghorn cock on light Brahma hens will be satisfactory. Where one wishes to make eggs a specialty only pullets should be kept for the purpose, and the earlier they are hatched the better. Don't keep hens over more than one winter unless for some good reason.

When the proper accommodations are furnished and the proper breeds selected, the next and most important step is the feeding. Egg-production is hard work for hens, especially for those that are large layers. An egg is a highly organized and complex substance. It is for the most part composed of albuminous matters and oils or fats, together with fibrin, phosphorus, sulphur, iron, etc., in small but appreciable quantities. An egg is a potential chicken. The hatching process adds nothing to the contents of the egg, but only develops the chick from the substance already there. Thus in an egg there is the material for bones, flesh, blood, brain, nerves, feathers, and all the organs of life. Hence egg-production considered physiologically is an exhaustive process when hens lay regularly and constantly. Furthermore the shells of eggs are composed almost exclusively of carbonate of lime. When a hen lays freely she requires a supply of the raw material from which to secrete this carbonate, and it should be furnished to her at all times. Is it a wonder then that hens, as they are ordinarily kept, do not lay in winter? Their food must contain the materials from which they secrete eggs or they cannot lay. Probably nine-tenths of all the poultry in the country are fed on raw, whole corn. We know that corn contains all the elementary substances that eggs do, but in very much smaller quantities bulk for bulk, and when a hen has no other food she cannot eat enough to afford the materials for an egg a day, or every other day. She will get fat and lazy, but cannot lay. Hence the necessity for a variety of diet. In summer, when at liberty, the hens can find the variety of food that suits them, and generally lay well without much care; but in winter they can get only what is given them, and generally they do not lay. But if we know the wants of the hens and supply them we may have as many eggs in winter as in summer. Poultry are large consumers of grass when they can get it, and to keep in good health they must have it or its equivalent in winter. Cabbages or boiled vegetables of any kind are good substitutes. Grass if cut green and carefully dried in the shade, when cut fine and steeped a while in hot water is nearly as good as green grass, and is eagerly eaten in winter. Besides grass or its equivalent we must give a supply of lime. Oyster shells when they can be had are the most convenient; when they cannot be had ordinary stone lime from the kilns will do as well after it is slacked, but gravel must be supplied with this latter form of lime. Domestic poultry must be classed among the omnivorous animals. There is nothing that can be eaten that a hen will not eat if she can get it; any kind of odds and ends, therefore, will not come amiss, and much refuse matter that would otherwise be wasted may be thus turned to good account. Hens are very large consumers in proportion to their size, and scanty feeding in winter will not do. They should have as much as they want to eat and as often as they want it, especially when they are laying well. They should be supplied with animal food in some form, offal meat, cracklings, chandler's scraps, thick sour milk, etc., will give the necessary supply.

It thus appears that an egg is a complex substance; that it is composed of the highest products of secretion; that egg-production is an exhaustive process to the hen; that to produce them in large quantities we must supply the proper variety of diet, and plenty of it; and to keep up the health and strength of the hens they must have green food and animal food in winter.

I have made out a bill of fare for my hens based upon physiological principles, keeping in view the composition of the egg itself, and the health and comfort of the hen. I will not occupy space in showing why this is in accordance with theoretical principles or analytic results. I do not claim that it is the best or the only way to feed hens, but it has answered so well with me that I do not know how to alter it for the better. My hens have laid enormously, and have, through the medium of printer's ink, become famous.

This is how I feed: Their morning feed consists of cracked (very coarsely ground) corn, wheat screenings, or wheat, or oats, and wheat bran scalded and fed warm in a trough. This is given them as soon as they can see to eat. As soon as they are fed I break up a pound of oyster shells for thirty-five head. Then they have fresh water from the pump, as much as they will drink. Fowls often suffer for water in winter. After I have had my own breakfast I give them about a pound of scraps or cracklings from the chandler's shop. This is broken in pieces with a hatchet. It furnishes animal food, and is cheap; fresh meat is better, but dearer. I give two or three quarts of thick sour milk every day, with a handful or two of wheat bran stirred into it. Besides this, I feed some cabbage, or turnips, or potatoes every day. At noon, they have a little corn, or oats, or screenings, as the case may be, and fresh water again in clean vessels. At night, before roosting time, they get as much whole corn as they will eat, and fresh water again: I make it a rule to give as much as they will eat. A hungry hen will not be a laying hen. My hens never get too fat to lay.

The greatest regularity should be observed in feeding and caring for flocks. Have a regular time for all the different operations, and the hens will become as methodical as their keepers. Eggs should be gathered punctually twice a day, or oftener in very cold weather. The morning feed should not be made too wet, and should not be given too hot. If some of it freezes before it is eaten, break it up with a hammer and it will all be consumed. In very cold weather it is advisable to put a little cayenne pepper and a sprinkle of salt in their morning feed. Besides the above enumerated articles the hens should have all the scraps from the table. They are very fond of them, and will turn them to better account than cats or dogs will.

Let us recapitulate. Give your hens a reasonable share of your attention; furnish suitable accommodations; get and keep the right breed; do not keep too many. Fifty hens and four cocks are as many as should ever be kept together—half the number will do better per capita. Save only pullets, the earliest hatch for laying. Furnish as great a variety of diet as possible, and feed as much as they will eat. Give green food and animal food of some sort in winter. Keep the hens quiet and comfortable; don't allow them to be worried or frightened. Water is as important as food, and should be kept clean and fresh. These rules intelligently applied will secure an abundant supply of eggs at all times of the year.—*Fanciers' Journal*.