SIXTY-ONE BUSHELS OF WHEAT PER ACRE.

RECENTLY, while traveling through Lancaster County, Pa., we made it a point to visit the farm of Levi W. Groff, near Bareville, in that county. Mr. Groff has been experimenting on the cultivation of wheat; and last year his experiments were so satisfactory (resulting in double the yield heretofore) that this year he has put in thirty acres of wheat, and has it in the highest state of cultivation, having worked it through three times this spring; does not work it in the fall. In cultivating the wheat, Mr. Groff uses a wheat drill six feet between the wheels, and with four sowing tubes instead of eight. Each tube is so arranged with a spreader at the bottom of it as to put the seed in regular rows four inches wide, with nearly eleven inches of space between the rows. The distance between the outside tube and the wheel is the same as between the tubes. This leaves the space between the rows wide enough apart for the horses to walk between them without treading down the wheat. In using the drill for cultivation, the drilling tubes are removed and the three-clawed cultivating hoes are attached—being the same distance apart as the drilling tubes. The claws of the cultivating attachment are in triangular groups, the center one in advance of the two outer ones, which prevents clogging, leaving the ground even and clean. Protectors are also fastened on to prevent the wheat from being covered up by the dirt as it is thrown up by the claws, and they do the work perfectly. We witnessed the operating of the cultivator, and examined its work closely. It leaves the ground fresh, loose and mellow, instead of beaten compactly by the spring rains. The whole thirty acres presented a delightful and pleasing appearance. The wheat looked vigorous, uniform in height, firmly set, rich in color, having that peculiar shade of green which indicates a healthy state of the plant.

We closely compared it with adjoining fields on other farms having equally good soil, equally enriched with fertilizers, and as well put in, but put in with the common drill. It really would not admit of comparison. There was a difference of almost one-half in favor of the cultivated wheat. Mr. Groff informed us that last year he raised sixty-one bushels per acre by his mode of cultivation, being about double the usual yield on that land. The straw is heavier and much less liable to lodge, and the heads and grain grow much larger. A good crop of clover hay had been taken off last fall after the wheat had been harvested, which shows that it does not interfere with the sowing of clover and timothy in the spring; and as good clover we never saw as we did on this farm, following last year's cultivation.

If we were to judge the yield of wheat from the present appearance, we should say that Mr. Groff will be paid many times over for the small amount of extra labor required in cultivation.—*Practical Farmer.*

CRANBERRY CULTURE.

Read before the American Institute Farmers' Club, by J. EDWARD WING.

In presenting this statement of the results of cranberry culture in Eastern Massachusetts to you, I simply give you facts and figures as gleaned from the agent of the Newton Cranberry Bog, which is situated in the town of Barnstable, Barnstable County, Mass.

This piece of swamp land in its original condition was of very little value; the almost only growth upon it was a few stunted pines, low laurel bushes, and an abundance of low green moss, and it was pronounced by an experienced cranberry grower as unfit for cranberry culture, but the results have seemed to prove otherwise.

The bog was prepared in the following manner: 1st. The trees, bushes, and about eight or ten inches of the moss were removed, and the most of that was used to fill low places—was burnt on the bog—then ditches were opened about four or five rods apart, running parallel with each other into the main stream; then, after being made decently level, covering with about two inches of coarse sand or gravel, after which the ground or bog was set with vines, in hills, eighteen inches apart each way. Subjoined I append a statement of the cost of swamp, upland, buildings, etc., together with the expense of preparing the same, and the net returns made to the owners of the cranberry bog, containing a few rods less than sixteen acres, as follows:

Purchased the premises early in the year 1864—

And with the cost of preparing about six acres
and setting with vines, paid out..... \$2,507 66
In the year 1865, four acres, est..... 2,367 28
In the year 1865, the balance 1,203 31

Total expense paid by owners..... \$6,103 62

In 1867 the bog was finished, and the expenses of the year for finishing, weeding, etc., were paid from the proceeds of the cranberries raised, and the net amount, free from taxes, which were paid by the agent, divided among the owners each year to date, and the number of barrels harvested, as follows:

In the year.	Barrels.	Over all expenses.
1867.....	74	\$ 12 86
1868.....	297	1,797 36
1869.....	391	2,506 72
1870.....	490	3,953 84
1871.....	1,258	6,300 16
1872.....	1,040	8,200 00
1873.....	1,020½	4,000 00
1874.....	1,078½	4,400 00
1875.....	463	1,980 68
1876.....	859	5,840 00
	6,979	\$38,991 62

In 1875 the bog was seriously injured by a late spring frost, and somewhat so in 1876. A fair crop is on it this season, except on about two acres cut off by the vine worm.

In cultivating, the practice has been to clear the weeds and wild stuff from the vines spring and fall, and in summer, when it can be done without much injury to the crop.

By the foregoing simple process much of the unproductive and seemingly worthless land in this country has been brought into profitable cultivation. In other words, the wilderness of stagnant swamps on Cape Cod have been made to blossom and bear fruit, to the joy and satisfaction not only of the cranberry grower, but to all who have the privilege and pleasure of the healthful fruit in its varied preparations for the table.

ATTICA is now a torrid desert for six or seven months every year. The lazy, ignorant cultivators burn their wood to fertilize the hills with the ashes, and by May all is parched and pulverized.

BEEES.

AN American correspondent writes asking Mr. A. R. Wallace, through *Nature*, his opinion as to the genus *Apis*. Are *dorsata*, *zonata*, *indica*, *adansoni*, *nigro-cincta*, and *floreana*, each or all distinct species? or, our correspondent asks, are some of these, like *ligustica* and *fasciata*, simply varieties of *mellifica*? Also as to structure and habits of *A. dorsata* and others, which Mr. Wallace has personally seen and handled.

The following reply has been sent us to these queries: Mr. Alfred R. Wallace having suggested that I should answer the queries of your American correspondent, I do so at once, having in the year 1865 published in the *Annals and Magazine of Natural History*, a somewhat elaborate paper on the subject on which information is sought for. The species that in my opinion are distinct are *Apis mellifica*, *A. adansoni*, *A. dorsata*, *A. zonata*, *A. unicolor*, *A. indica* and *A. florea*. I do not consider the examination of worker bees only sufficient material to enable any one to form a decisive opinion as to species; the examination of drones, also, I consider indispensable; it is advantageous to see queens, but those which I have seen do not present any very marked peculiarities indicative of specific distinction. I possess males and workers of *A. dorsata*, *A. indica*, and *A. florea*. That *A. ligustica* and *A. fasciata* are climatal varieties of *A. mellifica* has been apparently proved by the fact of their having in England reverted to the original stock, *A. mellifica*; there is, however, a remarkable fact to be noticed—that, notwithstanding the change referred to, they still possess a much greater degree of irascibility than *A. mellifica*; *A. fasciata* undoubtedly in the greatest degree. I consider *A. zonata* distinct from *A. dorsata*, its nearest ally; it is a larger bee, jet-black, with snow-white bands on the abdomen; I have not seen *A. dorsata* from Celebes, where *A. zonata* was discovered by Mr. Wallace, but he found that species in Sumatra, Flores, Timor, and Gilolo. *A. adansoni* and *A. nigro-cincta* will probably prove to be climatal varieties of one species, the latter being a pale form with dark bands. There is no doubt of *A. indica* being a distinct species; all the sexes are known, and there is no other species found in India with which it could be assimilated. Of the specific distinction of *A. florea*, the remarkable structural formation found in the drone, that of a lobe on the metatarsus, is conclusive; it is also much the smallest species known of the genus *Apis*. *A. unicolor* inhabits Madagascar, Mauritius, and the Island of Rodriguez; a considerable portion of a swarm was obtained from the latter island, an examination of which inclines me to consider the insect much more than a climatal variety of any other species; it remains that the drones and queens should be obtained in order to decide the question; until this can be effected I shall consider *A. unicolor* a good species.

Of the habits of the species of the genus *Apis*, Mr. Wallace, Sir John Hearsey, Dr. Jerdon, and Mr. Chas. Horne have given some interesting particulars. *A. dorsata* suspends its mass of combs on the branches of trees, quite exposed, having no covering whatever; Sir John Hearsey succeeded in obtaining a swarm which he secured in a box hive, thus domesticating the species, and obtaining from time to time quantities of delicious honey. Dr. Jerdon gave me combs of *A. indica*, which had taken up its abode in the rafters of an outhouse. Mr. Horne gave me the comb of *A. florea*; it is attached to a twig of some bushy plant. Dr. Welwitsch brought combs of *A. adansoni* from Angola; they were found inside a hollow tree; the cells are considerably smaller than those of any of the honey bees of Europe.—FREDERICK SMITH, in *Nature*.

THAT "FATHERLESS AND MOTHERLESS RACE."

THE BASKET-WORM, *alias* DROP-WORM, *alias* BAG-WORM (*Thyridopteryx ephemeraformis*).

By PROF. C. V. RILEY.

I READ with considerable interest the rather amusing but, in many respects, very excellent account of this insect by Mr. William H. Gibson in your SUPPLEMENT, No. 138. He lays himself open to the very charge of mere "mental deduction" which he makes against Dr. Packard and the other authors whom he quotes. He further falls into the same error committed by so many other observers, having no special knowledge of the subject treated. His errors are, however, pardonable, as the question he has been endeavoring to solve was never rightly solved until the year 1869. Had Mr. Gibson ransacked the libraries of the country sufficiently to have met with Vol. II. of the *American Entomologist* (which, by the way, is pretty nearly in every entomological library in the country), he would have found in the number for November, 1869, an article by myself giving a full account of the insect which has so interested and puzzled him, and an explanation of the mode of impregnation. For the benefit of your many readers I will here repeat some of the observations there recorded. Dr. Harris wrote to Edward Doubleday, on the 29th of October, 1849 (*Entomological Correspondence*, p. 179), as follows:

"The males are disclosed in September and the early part of October, and immediately afterward the females will be found to be impregnated. I examined about fifty female follicles on the 25th of October, and found all the females escaped, and their puparia half full of fertilized eggs. It is not true that the females remain in their puparia or in their follicles. Among all those examined as above mentioned not a single female was discovered; they had come out of their pupa skins, and had also left their follicles. It is only at an early period, or, in some rare cases, when the females have remained unimpregnated till this time, that any females are to be found within their pupa skins. But they do not leave their pupa skins until they have been impregnated and have laid their eggs.

"How the male contrives to get at the female is a mystery that I have not yet solved. The pupa skin of the female splits in the middle of the little carinated ridge found on the top and fore part of the thorax, and also laterally, so as to admit of a kind of T-shaped opening. It is through this that the male organ must be introduced, and, passing between the back skin of the pupa and the body of the female, reach her hinder extremity in the bottom of the pupa skin. But, in addition to this extent to be penetrated, the male has to penetrate the whole length of the lower orifice of the follicle, say half an inch, before he can reach the head of the puparium. The female lays her eggs in the puparium or pupa shell, receding from it as she does so, and filling the shell half or two-thirds full of eggs. The rest of the shell she fills with a fawn-colored down, rubbed off her own body."

In order to elucidate and forever settle these two points in the natural history of our Bag-worm, I closely studied the habits of this insect, and not only examined hundreds of specimens in the open air, but reared great numbers within doors from the egg to the perfect state, watching their op-

erations day by day. The females of several insects which inhabit similar follicles (genera *Oecetis*, *Psyche*, etc.) are perfectly wingless. They are, indeed, the most degraded and imperfect of moths, and afford a marked exception to that very general, but not universal rule, as laid down by Agassiz, viz., that the earliest condition of an animal cannot be its highest. It is well known that certain European species never quit their follicles, and that the shrunk body not only lies near the orifice and protects her eggs, but that it forms the first food of the young larvæ, who play the carnivorous role for the first moments of their lives by subsisting on the remnant of their mother's body. It is consequently stated by most European authors as a characteristic of the group that the females never quit their cases. But as Harris well remarked in the above extract, the insect of which we now write forms an exception to this rule.

The manner in which fertilization takes place is easily explained, though I am not one bit surprised that to Dr. Harris, and to all who have not given close attention to the matter, the *modus operandi* should be involved in such mystery.

The males of most insects mature before the females, but if we take a given number of our Bag-worm cocoons, one-half of which are males and the other half females, and cut them open at the time that the first male makes his appearance from the lot, we shall find that many of the females have already burst open the pupa shell at its anterior or lower end, and have worked themselves through the aforementioned T-shaped opening to the lower end of the follicle. The puparium is held tenaciously to the upper part of the follicle by the abundance of soft but tough silk with which the follicle is lined, but it is extenuated to nearly double its natural length by the efforts which the female makes in emerging. The female never withdraws herself entirely from the pupa shell, but holds on to it by her terminal segments, being evidently assisted by the ring of woolly hair already referred to. Thus, with the pupa shell extended to its utmost capacity, and the additional length of her whole body, she is enabled to reach to the lower orifice of the follicle, where she patiently awaits the male, and, after meeting him, works herself back into the pupa shell. Here she deposits her eggs in the upper part, intermingling them, and crowding the lower part of the puparium with the peculiar fawn-colored down already referred to. After having thus cozily secured her eggs against the winter's blast she works herself out and drops exhausted to the ground.

The eggs are very soft, opaque obovate bodies, about 0.05 in. long, and each is surrounded by more or less of the down which cannot well be detached from it, and seems to be part and parcel of the external surface. The fulvous or fawn-colored down is in reality extruded from the abdomen, and not rubbed off the body as stated by Harris. This fact becomes apparent when we consider the nakedness of the body, and may be proved by dissecting an impregnated female just before the laying of the eggs, or by a microscopic examination of the down itself. It is in reality a very fine silk and

THE BASKET WORM.

not hair. Not only are the eggs mixed with it, and the lower third of the puparium tightly crowded with it, but there is always an abundance of it mixed in with the white silk at the lower end of the follicle, and evidently scattered by the emaciated female in her exit.

Follicles in which the female is waiting for the male may be distinguished even without cutting into them, for her body entirely fills up their lower third, which is otherwise contracted and empty. In a state of nature the females scarcely ever fail to get impregnated, but in confinement a majority of them thus fail, and in such an event they remain at the lower part of the follicle until death. Out of 82 female follicles that were set apart by myself in September, 1869, in a separate cage, so that no males could reach them, every one of them died in this manner, and I could not find a single attempt at virginal reproduction, though very closely allied species have been known to produce impregnated eggs without fecundation, and the fact of virginal reproduction mentioned by Mr. Gibson is not remarkable, though it must be looked upon as exceptional.

This Bag-worm is quite polyphagous, occurring on many kinds of deciduous and evergreen trees and even on cotton. Among the few trees which it does not attack may be mentioned the *Ailanthus*, and as the Bag-worm often becomes a serious pest in restricted localities, especially in more southern cities, this immunity of the *Ailanthus* is a great point in its favor as a shade tree. Two parasites (*Cryptus inquisitor*, Say, and *Hemiteles thyridopterygis*, Riley) are known to attack it.

The silk which lines the inside of the female case is extremely fine and strong, and could be easily carded and spun. It occurs in tolerable abundance, the quantity varying according to the character of the food-plant. Some experiments which I have been making lead me to believe that this insect which is now a real pest may some day prove valuable as a silk producer.

The female being so totally wingless renders the destruction of the pest tolerably easy by cutting off and burning all the cases upon a tree in winter time. It often multiplies so rapidly, however, as to utterly denude small trees, especially cedars and junipers and *Arbor vitæ*. In such case a thorough syringing of the tree with Paris green water, one tablespoonful of pure green to a bucketful of water, proves an effectual remedy, as I have learned from experience.

P. S.—I take the liberty of sending you figures of the insect in its different stages, which will illustrate the gravid female, which Mr. Gibson considers a myth, but which is nevertheless as much a reality as the male.