THESIS.

To what extent the insect is of aid in fertilizing the Drupes.

A. F. Hughes. 1896.

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Fertilization of plants

-: T H E S I S :-

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-: EXPERIMENTS TO LEARN TO WHAT EXTENT :-

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-: INSECT IS OF AID IN FERTILIZING THE DRUPES :-

A. F. Hughes.

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EXPERIMENTS TO LEARN TO WHAT EXTENT the Insect is of Aid in Fertilizing the Drupes.

It has been well said that everything in nature performs its part. No sooner are our flowers opened in the spring, than various species of insects are observed flying from flower to flower. It is well known that besides securing nectar and pollen for their own use that they are of service to the plant by distrubuting pollen to other flowers .

A superficial glance at any insect reveals the fact that they have contrivances which necessitate pollen being carried away by them. These appendages doubtless serve some direct purpose in the insect economy. But as he passes from flower to flower they take on and give off pollen continually. This constitutes one of nature's great plans for distributing pollen.

In the absence of the insect the pollen may come in contact with the stigma by being carried by the wind or falling from flowers above, etc. Indeed, with some of our trees they depend altogether upon the wind to fertilize themselves, notably the pines. But with the drupes the distribution of the pollen themselves accomplished is never so general and thorough, for the stigmas are small and comparatively smooth and the pollen is produced in small quantities.

Scientific investigation has given us much information along this line but has yet left open a broad field of inquiry. Orchardists frequently attribute a "poor set" in fruit to lack of proper fertilization of the ovules, caused by rain washing away the pollen or prolonged cloudy weather precluding the insects' work.

To determine to what extent the insect is of aid in fertilizing our fruits, and to gather such suggestions as arise therewith, was largely the purpose of the experiments to be discussed in this paper.

To gain this end a certain number of flower clusters on a tree were crossed and an equal number were merely covered and left to set fruit by self fertilization. The crossed ones would represent those to which the insect carries pollen from other trees, and the self fertilized ones those which the insect never visits. The covers used were manilla paper bags, which precluded all insects and yet admitted sufficient light so that at no time was there any noticable difference in the twigs under cover and the twigs on the rest of the tree. The bags were allowed to remain on until it wascertain that fertilization had taken place, as indicated by the dying of the stigmas.

It was found difficult on account of the cloudy and rainy waether. But this difficulty was overcome by maturing pollen in the house, which was easily accomplished by placing the twigs of opening blossoms in water. To prevent the

mixing of the pollen of the different kinds each twig was labled and wrapped in paper. By this means pollen could be kept for several days. In gathering the pollen it was selected somewhat promiscuously, that is, no special attempt was made to cross certain varieties. In some cases the relation was close in others different specimens were crossed again early and late varieties were crossed and vice versa. In other words, the work was made to represent to a certain extent that which takes place when the insect does the crossing.

Plum--- Speer.

This was fertilized by taking pollen from the Wolf. Eight clusters each containing six blossoms were chosen, of which one-half were costated. On May 12th, the following record was taken.

No. 1	Cross fertilized	6 set.	
" 2	" "	4 "	
" 3	" "	0 "	
" 4	" "	1 "	
	Total	11 - 46%	
No. 1	Self Fertilized	5	
" 2	" "	6	
" 3	" "	0	
" 4	" "	4	
	Total	15 - 62%	

In the above experiment Numbers 324 of both fertilized

and self fertilized were chosen on the trunk of the tree. The higher per cent of the self fertilized was propably due to a lack of sufficient pollen on theother lot. On May 29th, the tree was again visited and the following record was taken. None of the self fertilized ones were set; 50% of the crossed ones still remained. The fruit at this stage was of good color; but no attempt was made to compare the size on account of the early stage of the fruit.

Plum--- De Soto.

Fertilized with pollen from the Robinson. Ten clusters each having six blossoms were selected, five of which were crossed. On May 12th, they were visited with the following results.

No. 1 crossed had 5 set.
" 2 " " 5 "
" 3 " " 6 "
" 4 " " 6 "
" 5 " " 4 "
Total 26

No. 1 Self fertilized 2 set.
" 2 " " 5 "
" 3 " " 3 "
" 4 " " 5 "
" 5 " " 1 "
16

On May 12th, the self fertilized were not looking as well as were those which had been crossed. . The crossed

ones were looking finely, even larger than were those hanging upon the tree. On May 30th, the trees were again visited and none of the self fertilized were found hanging. 35% of the crossed ones were still looking well, and gave all indications of remaining until ripening.

Plum-- Moriana.

This was crossed with pollen from a Japan plum. Eight clusters of five buds each were chosen, four of which were crossed and the others were covered with bags. On account of lack of pollen these blossoms were allowed to stand for five days before they were pollenated, which caused no trouble as the following will show.

On May 14th, they were visited with the following result

No. 1	Cross	Fertilized	3
" 2	"	"	3
" 3	"	"	2
" 4	"	"	3
Total			11 - 55%
No. 1	Self	Fertilized	0
" 2	"	"	0
" 3	"	"	1
" 4	"	"	1
Total			2 - 10%

June 1st, they were again examined and of the self fertilized none were hanging. Of the crossed 40% were still

still hanging and gave good prospects of coming to maturity.

Lombard Plum.

This tree was exceptionally full of blossom buds. Eight clusters, each containing eight blossom buds were selected and four of these were crossed with pollen from the Wold plum.

On May 15th, they were examined with the following results.

No. 1	Crossed	7 set.	
" 2	"	4	"
" 3	"	3	"
" 4	"	2	"
	Total	16	- 50%
No. 1	Self Fertilized	6	
" 2	"	"	4
" 3	"	"	6
" 4	"	"	1
	Total	17	- 53%

The numbers four were placed on the trunk of the tree, which accounts for the small number set. At this time all of both the crossed and self fertilized were the same size and looked as well as any of the others on the tree. June 2nd, the tree was again visited and 38% of the crosses were still hanging and 35% of the self fertilized were still on, and all gave good evidence of coming to maturity. The above experiment shows that this tree is capable of self-fertilization.

Rollingstone Plum.

Crossed with pollen from the Wolf. Eight clusters with six buds on each cluster were chosen. The following is the record taken on May 12th,.

No. 1	Crossed	5	set.	
" 2	"	3	"	
" 3	"	4	"	
" 4	"	2	"	
	Total	14	- 58%	

No. 1	Self Fertilized	2	set.	
" 2	"	"	3	"
" 3	"	"	3	"
" 4	"	"	0	"
	Total		8	- 32%

On May 30th, the tree was again examined, and the tree itself had a poor set of fruit as compared with the number which the tree had after the blossoms had fallen. Twelve of the crossed ones were still hanging and were of larger size than any others on the tree, which would leave 50 % for the crossed ones. Of the self fertilized none were set.

Wild Plum (Prunus Americana)

A small cluster of these trees being hear at hand, and being ready to open just as the Wolf was beginning to blossom, it was crossed with pollen from the Wolf. Six were put under each bag. On May 18th, the trees were visited with the following result.

No. 1 Cross Fertilized	5	set.
" 2 " "	5	"
" 3 " "	2	"
" 4 " "	1	"
Total	13	
No. 1 Self Fertilized	0	
" 2 " "	1	
" 3 " "	1	
" 4 " "	0	
Total	2	

On June 4th, the trees were again inspected and 65% of the crossed ones were still hanging and gave all evidence of coming to maturity. But one of the self fertilized ones was hanging at the same date or 5%. It was expected that these trees being of a wild variety would set quite well to its own pollen. Perhaps the lack was owing to the fact that the trees were crowded quite closely together and in a blue grass sod.

Cherry---May Duke.

This tree being unusually full in blossom eight buds were put under each bag. There being several trees of the May Duke around, the crossed and self fertilized ones were chosen on different trees. On May 1st, the trees were inspected with the following result.

No. 1	Cross Fertilized		4
" 2	"	"	0
" 3	"	"	5
" 4	"	"	2
" 5	"	"	1
" 6	"	"	4
	Total		16
No. 1	Self Fertilized		1
" 2	"	"	0
" 3	"	"	1
" 4	"	"	0
" 5	"	"	0
" 6	"	"	1
Total			3

On May 29th, the trees were again visited and all of the crossed fertilized ones were ripe, but no special difference was noted except that they seemed to be in advance of the others. On the same date the self fertilized had but one hanging and it was of inferior size.

Cherry--- Kentish.

This tree was fertilized with pollen from the May Duke The tree being well filled with blossoms, ten clusters, each containing four blossoms were chosen, of which number five were crossed and the others were covere d with bags .

They were visited on May 2nd, giving the following results.

No. 1	Self	Fertilized	1
" 2	"	"	0
" 3	"	"	1
" 4	"	"	0
" 5	"	"	1
Total			3

No. 1	Crossed	2
" 2	"	2
" 3	"	1
" 4	"	2
" 5	"	1
Total		8

All these came to maturity but no special difference was noted in the size or otherwise except that the tree ripened rather unevenly and the crossed ones ripened all at the same time.

Choke Cherry.

There being no near relative of this tree in blossom pollen was taken from a tree of the same species about 1/4 of a mile distant. Eight clusters of six blossom buds on each were chosen. On May 18th, the tree was visited and the following is the tabulated result.

No. 1	Cross	Fertilized	3
" 2	"	"	4
" 3	"	"	4
" 4	"	"	4
Total			15 = 62 1/2 %

No. 1	Self Fertilized	5	
" 2	" "	5	
" 3	" "	1	
" 4	" "	3	
	Total	14	= 58 1/3 %

It can be seen from the above that the increase is not materially in favor of the crossed ones. No chance was given to watch the further developement of the fruit as the tags were pulled off by the children.

The wild black cherry was crossed with pollen from one of its own variety; but neither the crossed nor the self fertilized ones set a single fruit. Perhaps this was due to the fact that all of the eight clusters were selected in the center of the tree, and the tree being large and spreading hindered the ones in the center from receiving the sunlight which is necessary for all fruit to form. The outside limbs were hanging full while the center of the tree had no fruit at all. If the above is true it certainly stands the orchardists in hand to prune his trees so as to admit the sunlight into the center of the trees.

Out of the total 225 plum blossoms crossed, 125 were hanging May 13th. Of the self fertilized 125 were hanging at the same date. The ratio being nearly 2:1 in favor of the crossed. June 1st, 85 of the crossed ones were still hanging and gave all evidence of coming to maturity. Of the

16 self fertilized which were remaining but 10 gave promise of coming to maturity. And if we were to remove the record of the Lombard from the above it would give us a final ratio of 9:2 in favor of the crossed ones.

To recur to the figures of the cherry; we find that the total 68 crossed ones that 38 were still hanging May 12th, and that 30 of the self fertilized were still hanging. And at the last visit, May 26th, 36 of the corssed ones were still hanging; and of the fertilized 9 were still hanging, which would give us a ratio of four to one in favor of the crossed ones.

While the above record may be exaggerated in a few cases, taken as a whole it would leave no doubt as to the god to be derived from crossing. As already intimated nature has made abundant provision for this work in the host of insects which play about our flowers. Just how far the insect may be depended upon to carry pollen is hard to determine. However, in small orchards there is generally no difficulty experienced as there are upwards of a dozen or more varieties. But frequently in planting large orchards the mistake is made in planting a great many of the same variety together, a large share of which do not receive pollen from other varieties. The more such trees are sterile to their own pollen the greater is the loss, at any rate there can be no doubt as to the propriety of scattering the varieties. In the experiments recorded above over 50%

of the plum trees were found to mature no fruit by self fertilization. It would not be inferred from the limited range of the experiments that such trees were wholly sterile. But the trend of the experiment is emphatic in indicating the benefit of crossing.

On account of the warm weather hastening the opening of the cherry blossoms there was not given as much an opportunityfor working on the cherry blossoms as was hoped. It was suggested that it would be well to try the effect of crossing on some of our cultivated currants, accordingly the work was begun and the same methods were used as in crossing the drupes. The currants did not open their blossoms evenly, so those which were not ready to open were pulled off, care being taken not to injure the clusters.

The Currant Riber naguim.

This was crossed with pollen from the wild currant of the same variety. Eight clusters were chosen, four of which were castrated. The remaining were self fertilized. On May 16th, the following record was taken.

No.	1	Cross	fertilized	6
"	2	"	"	7
"	3	"	"	5
"	4	"	"	5

All the bags and tags were pulled off from the self fertilized ones except No. 4, which had none. On June 1st,

it was again inspected. Three or four of the crossed fertilized ones were still hanging and were much larger than the average.

Currant--- Dakota.

This was crossed with pollen from the wild species (R. nigrum) Four clusters were crossed each having five blossoms and an equal number were covered. On May 26th, they were visited and the following is the record.

No. 1	Cross	fertilized	3 set.
" 2	"	"	5 "
" 3	"	"	3 "
" 4	"	"	1 "

No. 1	Self	Fertilized	0 set.
" 2	"	"	0 "
" 3	"	"	1 "
" 4	"	"	0 "

On June 2nd, they were agin inspected and of the self fertilized ones none were hanging. Of the crossed ones eleven were still hanging and were twice as large as others on the bush; they also were much earlier in maturing. Nearly all of the fruit which had first set dropped off before attaining size. The fact that no other currant bush was close at hand, so that insects would probably carry pollen

will probably account for so few fruit maturing on the bush, as the above record will indicate that the tree is sterile to its own pollen.

Summing up the results of the currants we have the following: Of the 36 crossed ones 24 came to maturity; and of the same number of self fertilized ones but three came to maturity the ratio being as 8:1 .

The self fertilized ones were small and were quite late coming to maturity. One the other hand the crossed ones were twice as large and matured a couple of weeks in advance of either the self fertilized or those on the bushes.

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