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A NEW CECIDOMYIAD PEST OF MORINGA

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Introduction. A study of the fauna of flower buds of *Moringa pterygosperma* has revealed the presence of a number of insects such as caterpillars, thrips, Braconids, Chalcids and Cecidomyiads. The last named of these was sent to Mr. M. S. Mani of the Indian Museum, Calcutta who has described it as a new species.—*Stictodiplosis moringae* in the Records of the Indian Museum, Vol. XXXVIII. Part II. page 195. The present paper gives a short account of the life history and habits of the pest together with its natural enemies and the results of the trials for its control.

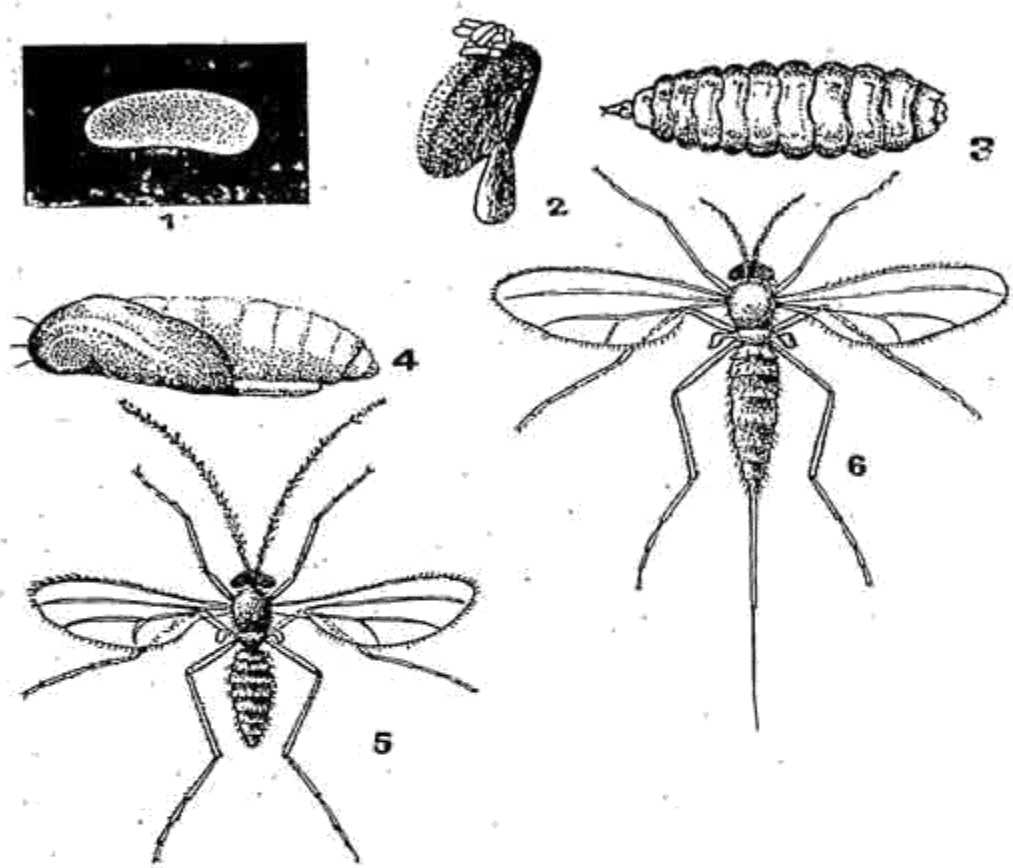
Description of the Fly. The description of the insect given by Mr. Mani is given below:

Female—Length 1·5 m. m; general color of body brownish black; mesonotum brown; scutellum brownish black; abdomen brownish black, two thirds the length of the body; Submedian lines densely setose; head with long setae; palpi densely setose, terminal segment rather very long; antennae short, third segment longest, its stem short, stout; fourth segment fused with third, somewhat shorter, with a very short stem, of a length about one and two thirds the diameter; fifth segment with a somewhat longer stem; sixth, seventh and eighth segments, shorter than fifth, their stems more slender and somewhat dilated apically; claw as long as empodium.

Male—Generally resembling the female; terminal palpal segment longest; antennae somewhat longer than body; stems of third segment half the length of basal and apical enlargements; fourth segment fused with third, basal stem two thirds the length of basal enlargement, apical stem three-fourths the length of apical enlargement; stem of fifth segment equal to the enlargements; basal stem of sixth segment a little shorter than basal enlargement, apical stem equal to apical enlargement. Terminal clasp segment of genitalia slender, bidentate apically; basal clasp segment apically emarginate on the inner side.

This new species can be readily distinguished from the only known Indian species *S. pulcherrima*, Kieff. by its much smaller size, paler color and other characters.

Life History and Habits of the Pest. The female generally selects buds about 4—10 m-m long for oviposition; very small and very big buds are avoided. The ovipositor is pushed into the bud through the white corolla and eggs are deposited in clusters (Fig. 1) mostly on the anthers. In some cases these may be found on the inner side of the petals also. It takes about 4—10 minutes for egglaying. The number of eggs in each cluster varies. In one bud as many as 80 eggs were noted in one cluster while the minimum was 5. Seven buds had 8, 10, 15, 20, 30, 40 and 45 eggs respectively in each cluster.



The Moringa Cecidomyiad (*Stictodiplosis moringae*, M.)

1. Egg.
2. Cluster of eggs on anther.
3. Maggot.
4. Pupa.
5. Adult—male.
6. Adult—female.

Eggs. The eggs (Fig. 2) measure about 0·18 to 0·23 m. m. in length and about 0·07 to 0 09 m. m. in breadth. It is slightly curved and transparent when freshly laid. Just before hatching it assumes a pale pink color. The egg period varies from 24½ to 31 hours. The following table gives the duration of the egg period.

TABLE I. Table showing the Duration of Egg Period.

No.	Eggs laid on	No. of eggs laid	Eggs hatched on	Egg period
1	9--3--37 9, a. m.	20	10—3—37. 3 p. m.	30 hours.
2	do.	10	do.	30 hours.
3	do.	20	do.	30 hours.
4	12--3—37, 9 a. m.	12	13—3—37, 3-45 p. m.	31 hours.
5	14-3-37, 9-30 a. m	6	15—3—37, 10 a. m.	24½ hours.
6	do.	24	15—3—37, between 1 & 3 p. m.	28½ to 30½ hrs.

Maggots. The newly hatched maggot is about 0·3 m. m. to 0·33 m. m. in length and of pale white color. As soon as it hatches out it moves about inside the bud and feeds on the internal tissues and grows bigger in size. The full grown maggot (Fig. 3) is about 1½ to 3 m. m. long and ½ m. m. broad and of light pink color. No galls are produced by the maggots as in some other species. When the buds drop or when the flowers open they come out and make cocoons of sand or soil with a slight lining of silk and pupate inside them. The maggots take about 2-3 days to construct cocoons and pupate inside them. The larval period is about 6-9 days. The following table gives the duration of larval period of a few maggots.

TABLE II Table showing the Duration of Larval Period.

Serial No.	No. of eggs laid	Eggs hatched on	Maggots pupated on	Larval period
1	2	24—1—37	2—2—37	9 days
2	4	24—1—37	1—2—37	8 ,,
3	16	24—1—37	1—2—37	8 ,,
4	25	15—3—37	21—3—37	6 ,,

Pupae. The fresh pupa (Fig. 4) is pale yellow in colour and measures 1-1 5 m. m. long and 0·5 m. m. broad. The color changes gradually and the pupa turns black before the emergence of the adult. The pupal period is 5-9 days. The table given below gives the pupal period.

Table III. Table Showing the Duration of Pupal Period.

Ser. No.	Number of maggots.	Maggots pupated on	Adults emerged on	Duration of pupal period.
1.	15	1—2—37	9—2—37	8 days.
2.	1	1—2—37	8—2—37	7 ,,
3.	5	1—2--37	9—2—37	8 ,,
4.	4	24—1—37	2—2—37	9 ,,
5.	11	11—4--37	17—4—37	6 ,,
6.	4	31—7—37	5—8—37	5 ,,
7.	4	Do.	6—8—37	6 ,,
8.	2	Do.	7—8—37	7 ,,
9.	3	Do.	8—8—37	8 ,,

Duration of Life Cycle. From the observations of the life history records given above it will be seen that the total life cycle of the fly from egg to adult stage is about 12-19.

Longevity of the Adults. The adults (Figs. 5 and 6) are short lived. With or without food, male or female, in no case did the fly live for more than three days. The average longevity is about two days

Nature and Extent of Damage. As a result of the attack of the maggots the flower bud loses its natural features and color; the corolla becomes pale yellow and shrinks thus giving prominence to the green calyx and ultimately the buds drop down. If the maggots are found in large numbers some appreciable damage is done to the buds. Counts of buds taken from February 1936 to February 1938 show that the maggots are found throughout the year in the Insectary and fields in the Central Farm, Coimbatore, the percentage of infestation differing in different months. The table below gives the necessary information.

TABLE IV. Table showing percentage of infestation of buds

Month	Percentage of infestation of buds		
	big buds above 10 mm.	Intermediate buds bet. 4 & 10 mm.	small buds below 4 mm.
February 1936	18·0	3·7	Ni
March ,,	1 9	Nil	,,
April ,,	Nil	0·9	,,
May ,,	0 9	Nil	,,
June ,,	Nil	,,	,,
July ,,	,,	,,	,,
August ,,	5·1	4·4	,,
September ,,	4·1	6·3	,,
October ,,	8·2	6·2	,,
November ,,	31·6	Nil	,,
December ,,	Not examined.	Not examined.	Not examined.
January 1937	21·6	3·0	Nil.
February ,,	13 0	2·8	,,
March ,,	8·9	6·4	,,
April ,,	4·6	0·7	,,
May ,,	5·0	0 9	,,
June ,,	1·0	0 9	,,
July ,,	2 3	5·8	,,
August ,,	14·2	9 6	,,
September ,,	13·1	5·0	,,
October ,,	44·7	24·6	,,
November ,,	48·9	32 0	,,
December ,,	66 2	26·2	,,
January 1938	31·0	5 9	,,
February ,,	9·3	4·3	,,

Natural Enemies. Mention has been made in the first paragraph that a number of other insects are also found in the buds. Two of these, one a Braconid (*Microbracon, s. p. n.*) and the other, a Chalcid, have been noticed to feed on the maggots. Though the former is seen in large numbers than the latter the incidence of the parasites seems to be low.

Control Methods. An internal feeder is always a difficult insect to tackle. Bordeaux mixture was, however, tried as a repellent but did not show any good effect. One method which can be suggested is to work up the soil underneath the tree so that the pupae may be destroyed.

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AGRICULTURE IN ANCIENT ROME

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In an earlier number of this journal, (Vol. XXIV No. 5, May 1936) an account of agriculture in ancient Greece was given. It was shown that the art of Agriculture was fairly well advanced in ancient Greece. The Romans not only improved the art considerably but also spread it in the countries conquered by them. Many of their learned men have written on the subject. The most important of these authors are Cato, Varro, Virgil, Columella, Pliny and Palladius.

Cato was the 'father of the Roman rustic writers'. His *De Re Rustica* is the oldest work on Roman agriculture. Varro had written 500 volumes on different subjects and his *De Re Rustica* is a valuable book on Roman agriculture. Virgil's *Georgics* may be considered as 'a poetical compendium on agriculture'. Columella's *De Re Rustica*, in twelve books, is 'a complete treatise on rural affairs, including field operations, timber trees and garden'. Pliny was a great naturalist and his Natural History, in thirty-seven books, gives much valuable information on Roman agriculture. The *De Re Rustica* of Palladius, a poem in fourteen volumes, is 'little more than a compendium of those works which preceded it on the same subject'.

Based on these works, the Rev. Adam Dickson, a Scotch clergyman published, in 1788, a treatise under the title of *The Husbandry of the Ancients*. The article on the agriculture of the Romans, in Loudon's Encyclopaedia of Agriculture, published about a century ago, was based on all these works. The materials for the following account of agriculture in ancient Rome have been taken from Loudon's Encyclopaedia.

Rome was founded by a company of robbers and runaway slaves under the leadership of Romulus. The chief, having conquered a small portion of Italy divided it among his followers, each getting one or two acres. For the first few centuries, the agricultural holdings were generally small and the lands were occupied and cultivated by the proprietors themselves. These soldier-agriculturists 'ploughed their fields with the same diligence that they pitched their camps, and sowed their corn with the same care that they formed their armies for battle'.

In course of time, when Rome extended her conquests and acquired large territories, rich individuals purchased large estates. These were either