4.4-Effect of insect growth regulators on the reproductive potential of *S. littoralis:*

Every pair, a male and a female adults of *S. littoralis* were treated by each of the tested compounds of insect growth regulators by preparing 10% sugar solution to contain 50 ppm of each tested compound to feed adults.

The crosses were put under observation for fecundity, egg hatchability and egg mortality.

Results of single pair crosses after feeding on IGR are presented in Table (21).

Results show that at the feeding with fenoxycarb sugar solution, the mean number of eggs of the crosses (T♀xU♂) and (U♀xT♂) were 664.0 and 368.4/female, respectively while the average number of eggs for the control (U♀ x U♂) was 709.6.

As a result of feeding adult with chlorfluazuron sugar solution, the mean number of eggs of the crosses were 314.6 and 350.0, respectively. Adult feeding with diflubenzuron sugar solution resulted in 505.1 and 588.3 eggs, respectively. On the other hand, the mean number of eggs laid were 766.0 and 495.2 produced when adult fed on 50 ppm of pyriproxyfen sugar solution, respectively.

The highest level of percentage sterility was recorded with cross (T♀x U♂) which fed on pyriproxyfen sugar solution (79.73%) followed by the cross (T♀xU♂) feeding on fenoxycarb sugar solution, while, the lowest level of sterility was (3.56%) produced from feeding males of *S. littoralis* on 50 ppm of chlorfluazuron sugar solution.

Table (21): Effect of insect growth regulators on the reproductive potential of *S. littoralis*.

Compound	Sex combination	Mean no. of eggs /female	% Hatchability	% Mortality	% Sterility
Fenoxycarb	T♀xU♂	664	24.4	75.6	72.36
JHA	U♀xT♂	368.4	85.13	14.87	3.56
Chlorfluazuron	T♀xU♂	314.6	37.26	62.74	57.79
IGI	U♀xT♂	350	81.71	18.29	7.43
Diflubenzuron	T♀xU♂	505.1	71.29	28.71	19.24
IGI	U♀xT♂	588.3	40.99	59.01	53.56
Pyriproxyfen	T♀xU♂	766	17.89	82.11	79.73
JHA	U♀xT♂	495.2	75.3	24.7	14.69
Control	U♀xU♂	709.6	88.27	11.73	-

In general, it could be concluded that the insect growth regulators fenoxycarb, diflubenzuron, chlorfluazuron and pyriproxyfen were potent against the cotton leaf worm *S. littoralis* since they drastically affected egg production.

Data also in table (21) show that feeding males on tested compounds (fenoxycarb, chlorfluazuron, and pyriproxyfen) in sugar solution had slight effect on percentage of hatchability. The percentage of hatchability was 85.13, 81.71 and 75.3%, respectively.

While, feeding male with diflubenzuron with sugar solution decreased hatchability to 40.99%.

Emam *et al.* (1988) studied the effect of diflubenzuron, teflubenzuron, chlorfluazuron and triflumuron on adults reproduction of *S. littoralis* in the laboratory at 25°C, 65 % R.H. and LD 16:8. Fecundity was decreased, significantly from 977 eggs/female in untreated adults to 628, 421, 385 and 240 eggs/female for adults feeding on 10% honey solution containing 1ppm teflubenzuron, 0.5ppm chlorfluazuron, 0.5ppm triflumuron and 20 ppm diflubenzuron, respectively. The corresponding values for inhibition of egg hatch were 49, 32, 44 and 81%. There were no significant effects on adult longevity. The subsequent F_1 progeny showed 85% larval mortality following treatment of adults with diflubenzuron and triflumuron, respectively. Chlorfluazuron, triflumuron and diflubenzuron caused considerably prolongation of the larval and pupal lifespan, from 35.3 days in untreated insects to 36.7, 38.1 and 38.0 days, respectively.

Hicks and Gordon (1992) determined the effectiveness of topical applications of the juvenile hormone analogue fenoxycarb against selected stages of *Choristoneura fumiferana*. Fenoxycarb prevented eggs at an early stage of embryogenesis (0-24 h old) from hatching. These eggs were more sensitive to the compound than older eggs (48-72 h old). Adult females constituted the most sensitive development stage; treated insects laid eggs that failed to hatch. Untreated females that mated with fenoxycarb-treated males laid infertile eggs.

Faragalla *et al*. (1984) showed that the rate of hatch from egg masses resulting from matings between adults of *Ostrinia nubilalis* that had been reared as larvae on a meridic diet treated with diflubenzuron at 7.8 or 15.6 ppm was lower than when the adults had been reared as larvae on untreated diets The hatch rate was reduced even when only one of the adults had been reared as a larva on the treated diet. Feeding larvae on the treated diet for only 1 day was as effective in reducing subsequent egg hatch from the resulting adults as was feeding them on the treated diet for 3, 5, 7, 9 or 11 days.

4.5- Effect of some growth regulators on the embryonic development of the cotton leaf worm egg.

This test was directed to show the effect of three JHAs (fenoxycarb, pyriproxyfen, tebufefenozide) and 4 IGIs diflubenzuron, flufenoxuron hexaflumuron and lufenuron) under several concentrations. Eggs were treated at 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24 hour and at age 30, 36, 42, 48, 60 and 72 hour in order to follow up the embryonic development of the tested eggs.

Data in table (22) show that, fenoxycarb, pyriproxyfen and tebufenozide have direct effect on the embryonic development in the egg between the 4^{th} hour and the eleven hour. It was between the 4^{th} hour and ten^{th} hour in the case of fenoxycarb and pyriproxyfen, but in the case of tebufenozide the direct effect was between 5^{th} hour and 11^{th} hour.

In the case of the other 4 tested IGIs, the effective time in treatment was between the 14^{th} hour and 19^{th} in the case of diflubezuron and between the 20 hr. and 42 hour, in the case of flufenoxuron but in the case of hexaflumuron and Lufenuron the effective hour for treatment was late (between the 23 hr. and 36 hr. and between 30 hour and 42 hour. respectively.

That means that the embryology of these tested eggs is affected during a fixed time of development. This time was in the early age in the case of JHAs compounds (between the 4^{th} and 11) hour, but this time was very late in the case of IGI normally in the second and third day of embryonic development.

Many factors affect the bioactivity of JHAs, i.e. the age of the eggs, the dose, the bioactivity of the compound, the time of treatment and method of treatment.

Olszak *et al.* (1994) evaluated the influence of some insect growth regulators (cyromazine, triflumuron, chlorfluazuron, teflubenzuron, diflubenzuron, flufenoxuron fenoxycarb and S-71639 [pyriproxyfen]) on eggs, larvae and adults of *Adalia bipunctata* and *Coccinella septempunctata* in the laboratory at 21-24°C, 70% RH and LD 16:8. The insects were treated in 3 ways by immersion for 5 seconds; by placing adults and larvae in a small container with 2 leaves from a treated tree; and by feeding adults with aphids contaminated by a recommended concn. of an insect growth regulator. The tested growth regulators affected all the development stages of both coccinellids, but the results varied according to stage, way of treating and kind of chemical used. Some of the insecticides (teflubenzuron, fenoxycarb and flufenoxuron) elicited a drastic reduction of fecundity.

Assal *et al.* (1983) studied the ovicidal activity of the synthetic pyrethroids, deltamethrin, fenvalerate, cypermethrin and fenpropathrin (Meothrin) and the chitin synthesis inhibitors diflubenzuron and triflumuron against *S. littoralis* (Boisd.) as compared with chlorpyrifos and methomyl in the laboratory by topical application. They found that the pyrethroid showed a much higher ovicidal activity than the standard compound, deltamethrin being the most effective. Diflubenzuron caused higher rates of egg mortality than the standard compound or

triflumuron. In all cases, eggs 2-3 days old were less susceptible to the effects of the tested compounds than those 0-1 day old.

Mandal and Choudhuri (1984) studied the effects of the juvenile hormone analogues; hydroprene and methoprene on the hatching of eggs of the cotton pest *Earias vittella* (F.) in the laboratory. The ovicidal activity of both compounds increased with the increase in concentration, while decreased by increased egg age. Hydroprene was more effective than methoprene.

Ascher and Eliyahu (1988) assayed S-31183 [2-(l-methyl-2-(4-phenoxyphenoxy) ethoxy) pyridine] against eggs of the noctuid *S. littoralis.* They found that fresh eggs (0-1 days old) were very susceptible to the tested compound at 0.05 ppm, the response was much poorer with 1-2 day old eggs, while 2-3 day old eggs were unaffected even at 100 ppm.

Mridula *et al*. (1994) studied the effects of diflubenzuron on eggs of *Diacrisia obliqua* [*Spilarctia obliqua*] in the laboratory. Eggs aged 0-24, 48-72 and 96-120 h were dipped for 2 min in 5, 25, 50, 100, 250, 500 and 1000 p.p.m. diflubenzuron. The LC_{50} was 29.5, 90.0 and 680 ppm. for 0- to 24-, 48- to 72-, and 96- to 120-h-old eggs, resp. Abnormal adults emerged from 0- to 24-h-old eggs treated with 100 p.p.m. diflubenzuron.

Yokoyama and Miller (1991) tested pyriproxyfen (a juvenile hormone mimic) which had ovicidal effects on eggs of codling moth, *Cydia pomonella* (L.) and oriental fruit moth, *Gmpholita molesta* (Busck). One-day old codling moth eggs were more susceptible than 2-days-old eggs

Meisner *et al.* (1987) examined diflubenzuron, PH 60-43, penfluron and triflumuron for their toxicity to eggs of different

ages of noctuid, *Earias insulana* by using dipping technique. The results showed that except penfluron, the other tested compounds were highly active at 0.01%. The mortalities of 0-1 day-old and 1-2 day-old eggs were > 90% with triflumuron at 0.005%; while PH 60-43 showed more than 90% egg mortality regardless of the age of eggs under test. The authors further stated that both compounds were inactive against 2-3 day old eggs even at 0.1% concentration.

Laboratory study was carried out by **El-Guindy *et al.* (1983)** on the ovicidal action of 4 insecticides and 3 insect growth regulators on eggs of susceptible strain of *S. littoralis* (Boisd.) with various ages. They indicated that the most effective compound against 0-1 day old eggs was diflubenzuron, followed by triprene, methoprene, chlorpyrifos, cypermethrin, fenvalerate and methomyl. The susceptibility of the eggs decreased as the age increased.

For that it was necessary to follow up the embryological development in the cotton leafworm eggs to study the bioactivity of the tested compounds on the embryological development of the treated eggs.

4.6- The embryonic development of the cotton leafworm *Spodoptera littoralis* egg*:*

4.6.1-External description of the egg of the cotton leafworm *S. littoralis*:

In this part of study the researcher used a light microscope with monitor and digital camera was used, cannot display image IMC 1736 JPG with teftlco monitor.

The egg of the cotton leafworm *Spodoptera littoralis* (Boisd.). is approximately 0.5 mm. in diameter and 0.32 mm in height. It is low dome –shaped egg. The base chorion is rather narrower than the diameter about one third the way up. The chorin of the egg is sculptured with ridges or ribs radiating outwards and coursing downwards from the rosette-form micropyle. The series of vertical ribs are joined by a crossing series of ribs.

The color of the eggs varies, it may be pearly white, yellowish green or light golden brown with iridescent reflections. The variable colour is partly due to the stage of incubation and lighting.

Shortly before hatching the egg turn dark to blackish owing to the pigmentation of the head and body bristles of the young larva within.

Nearly same description of the egg was reported before by **Willcocks and Bahagt (1937) and Helal (1976).**

4.6.2-External description of the egg of the greasy cut worm *Agrotis ipsilon.*

The egg of the greasy cut worm *Agrotis ipsilon* is more usually dome-shaped because the base gets well flattened. In dimensions it is about 0.5 mm in diameter and rather less than that in height. There is a low nipple- like micropylar prominence, from which radiates a series of forked ribs, all of the same length, jointed at regular intervals by short cross ribs.

The eggs are very pale yellowish, but as incubation proceeds color changes take place. The yellow darkness, it becomes more of a brownish yellow to the eye, then a polar blotch and an irregular zone about the middle develop-both of a dull mahogany color. Then the egg color changes to orange mixed with yellow except for the reddish zones. Shortly before hatching the egg turn dark to black owing to the pigmentation of the head and body bristles of the young larva within. Nearly same description of the egg was reported before by **Willcocks and Bahgat 1937 and Helal 1976**.

4.6.3-Internal description of the egg of the cotton leaf worm *Spodoptera littoralis*

By using an Euromax microscope provided with a video attached unit, and a digital camera, Cannot display image IMC 1736 JPG with tftlco monitor, the author succeeded to follow up the development of the embryo in the egg.

By dipping the egg in sodium hypochloride solution for 5 minutes, the inner part of the egg became very clear.

Newly laid egg (less than 15 minutes), contain internally a large central yolk mass surrounded by a thin layer of periplasm

which in turn is covered by the vitelline membrane, (figure 33). A protienaceous chorion put on the egg while it is in the ovary provides a protective covering for the egg.

The periplasm is a differentiated layer of protoplasm covered the whole surface of the yolk. It is divided into two layers; the outer is granular, strongly vacuolated cytoplasm. It is packed with numerous, small, irregularly shaped vacuoles and has a spongy appearance, this outer layer is thinner. The inner layer is thicker and homogenous, being unvacuolated and densely granulated.

Sperm released from the spermatheca of the female passes through the micropyle, a narrow channel through the chorion as the egg pass down the oviduct on its way to be deposited.

The egg nucleus is diploid until the entry of the sperm stimulates meitotic division (maturation) leading to the haploid egg nucleus.

Union of a sperm nucleus with egg nucleus produces the zygote and stimulates the zygote to begin divisions.

The yolk consists of three regions: 1-the central core, 2-the auflosungzone (zone of solutions), 3-outer zone. The yolk in outer region lies between the auflosungzone and the periplasm is similar in character to that in the central core, (figure 34).

The yolk after the passage of the cleavage nuclei through it, becomes more homogenous and neither the three regions nor the cytoplamic reticulus can be distinguished in spite of the fact that the yolk no longer appears morphologically differentiated after passage of the nuclei. There is some indications that it remains physiologically differentiated, figure 34). This is

because the yolk nuclei, a few hours after formation of the blastoderm, become localized in definite regions at yolk.

Superficial cleavage of the zygote yolk and cytoplasm occurs in eggs during the first few division but yolk cleavage causes after a few divisions.

Zygotic divisions produce large numbers of nuclei lacking cell membranes but each surrounded with a small field of cytoplasm. These nuclei and associated cytoplasm are called energids. Energids gradually migrate into a single layer near periphery of the egg, forming the blastoderm. Cell membranes become complete after blastoderm formation. A few cells, the cleavage cells aggregate at the posterior end of the egg are the first to become committed to a future developmental track, they will Become the gametes of the adult. Cells on the ventral side of the blastoderm enlarge and become committed as the germ band, the cells that will become the embryo. Maternal and zygotic genes control subsequent development of the germ band.

Most of them become localized in the auflosungszone. A smaller numbers are located in the center of the egg and around the periphery, close to the blastoderm.

At oviposition, the egg nucleus (= germinal vesicle) is in metaphase or anaphase of the first maturation division. The nucleus (polar plasm or richtangsplasm which is lies in small hemispherical, inward expansion of the cortical ooplasm, in the upper half of the egg, at a constant distance about 50 degrees from the micropyle.

The sperm lies in a small cytoplasmic island in the yolk just beneath the micropyle. Later it forms a pronucleus which remains in this position until the female pronucleus fuses with it.

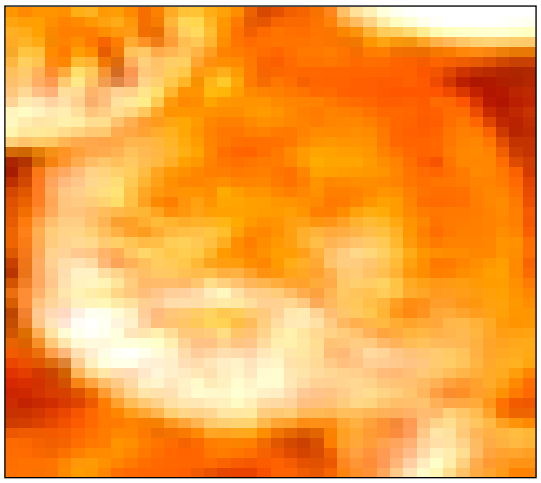


Figure 32: External view of the greasy cut worm egg.

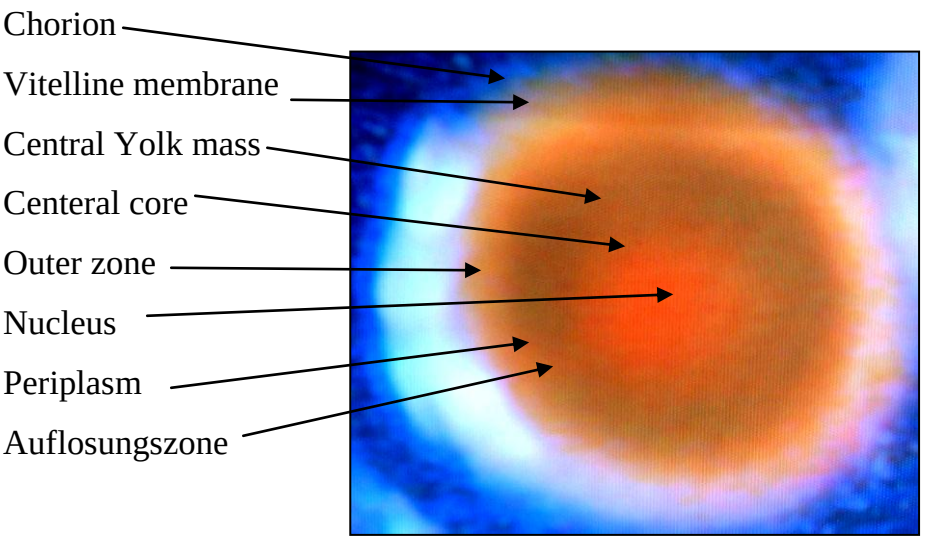


Figure 33: The yolk is surrounded by periplasm and vitelline membrane.

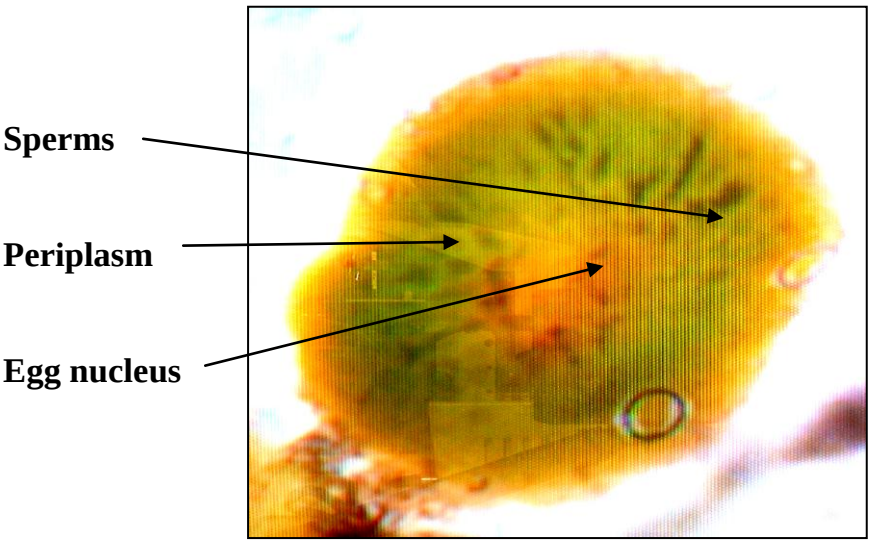


Figure 34: The sperm lies in a small cytoplasmic island in the yolk just beneath the micropyle.

From the germinal vesicle, (figure 35a, 35b and 35c) are derived three polar bodies and the female pronucleus which migrate to the position of the sperm nucleus where fertilization takes place.

Fertilization is accomplished at 30 minute following oviposition. At the end of 45 minute, three polar bodies are found in the polar plasm and the female pronucleus has fused with the sperm.

The synnucleus is located where the sperms was found. This suggests that fertilization occurs after an inward migration of the female pronucleus, following the second maturation division.

About one hour after being laid, fertilization was accomplished and Zygote nucleus had given rise, by two rapidly successive divisions to four cleavage nuclei, (figure 36).

The polar bodies fuse into a single vesicle at the time of the second cleavage division. So at approximately the time when four cleavage nuclei are present in the egg, the polar bodies fuse into a single vesicle located centrally in the richtungsplasma, (figure 35).

From the position of the zygote, nucleus just beneath the micropyle, the cleavage nuclei, as they divide, spread out into a roughly spherical, hullow configuration figures (37 and 38). The egg now with its cleavage nuclei is a syncytium. The cytoplasm of all cleavage nuclei is continuous with that of the cortical layer.

At the point in which the egg with its cleavage nuclei from a syncytium, the nuclei are very aligned in a hollow, subspherical arrangement. Nuclei were observed to enter the cortical coplasm first at the ventral pole of the egg.

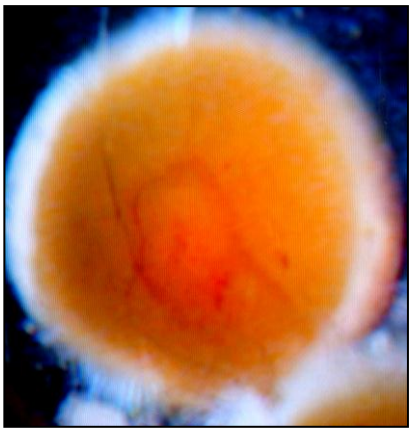


Figure 35a

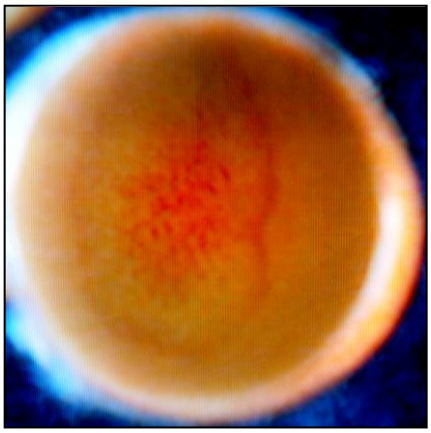


Figure 35b

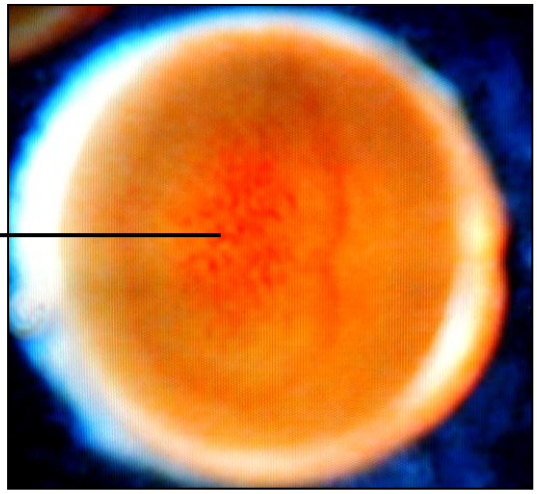


Figure 35c

The germinal vesicle, (figure 35a, 35b and 35c) are derived three polar bodies and the female pronucleus which migrate to the position of the sperm nucleus where fertilization takes place.

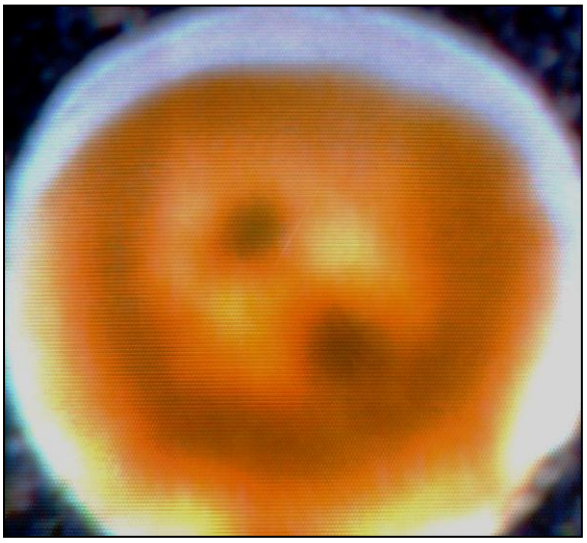


Figure 36: Zygote nucleus had given rise, by two rapidly successive divisions to four cleavage nuclei.

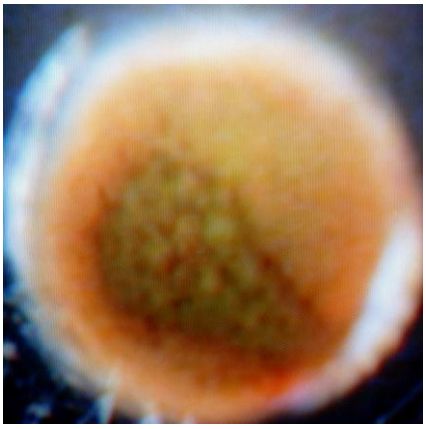


Figure 37

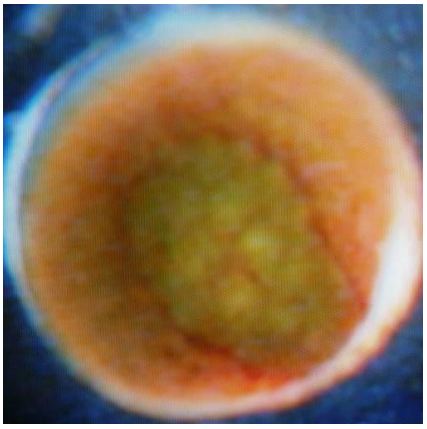


Figure 38

Figure 37&38: The cleavage nuclei, as they divide, spread out into a roughly spherical, hullow configuration.

At the beginning of the fourth hour after egg deposition, the outwardly migrating cleavage cells approach the periplasm, and begin to enter it. At this point the nuclei are very definitely aligned in a hollow, subspherical arrangement. Nuclei were observed to enter the cortical ooplasm first at the polar region of the egg.

By the end of the fourth hour after oviposition, all the future blastoderm nuclei have entered the cortical ooplasm, Figure 39 and 40. Certain cleavage nuclei witch lag behind in the advancement to the prephery, and few others apparently late in arriving at the cortical ooplasm, fail to enter it, these nuclei remain in the yolk as vitellophages.

The blastoderm is uniform in its distribution of nuclei throughout invagination from the surface progress gradually inwards between these nuclei and when they have reached almost to the base of the blastoderm figure 10. They spread laterally. In this manner the nuclei, each with its surrounding cytoplasm are incorporated in separated cells. At the completion of this process the blastoderm is a uniform layer of rather large mononucleate cells. Below the blastoderm and separating it from the yolk lies a basement membrane.

Then cell division continues. But whereas the cells in the equatorial region divide repeatedly by mitosis, the cells in the polar regions undergo one or two amitosis divisions not accompanied by cell wall formation. These cells then are bi-tri- or quadric-nucleate.

Nuclear division in this area continues, accompanied by only partial cytoplasmic division, with the result that there is

soon marked off a dumbbell-shaped area of polynuculate cells. The polynuculate cell will undergo no future multiplication but grow laterally over the remainder of the blastoderm through a flattening out process to become the serosa.

The cells in the broad equatorial zone will become the germ band. Overgrowth of the germ band by the serosa begins. Then the serosa completely encloses the germ band and yolk. Growth of the aminion is not observed until the serosa is complete.

After about 32 hr. the germ band lies curled laterally around the egg forming a cup-like disk with inturned edges penetrating yolk. Its ventral surface is covered by the aminion and serosa and the inner surface is contact with yolk.

While the serosa and aminion are being formed, the germ band increase in size through active mitosis, forming a cup-like highly columner cells with interned edges penetrating yolk.

A distinct difference can be seen between the anterior and posterior ends of the germ band of 18-20 hrs. old eggs.

The enterior end near the micropyle, is narrowing more rapidly than the posterior end and the head lobes are beginning to appear, figure 43.

Cell proliferation from the germ band for forming the mesoderm is recorded at 32-50 hrs, figure 43.

The invagnation of the germ band is initiated near the middle of the embryo and progress both forward toward the cephalic lobes and backward toward the caudal end to form mesoderm at 50 hr. The development of a germ band of two

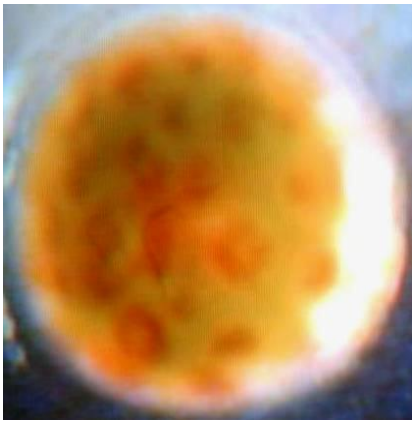
definite layers, the ectoderm and mesoderm. Segmentation of the ectoderm follows the establishment of this segmented mesoderm, figure 44, 45 and 46.

During the early development of the embryo and the period of completion of the body wall, as it assumes the form of a larva, the embryo undergoes a number of changes in position in the egg, all of which can be included under the general term blastokinesis.

The germ band after its differentiation, continue to increase in length with the head and tail pushing more deeply into yolk until it reaches a maximum length at about 18 hours, figure 42. During this period and about 30 hours after egg deposition, the embryo maintain the same position in the yolk, with the anterior end near micropyle. At this time it begine to endergo a rotation through 90 degree so that at 36 hour, it lies wrapped around the equator of the egg. At the same time it shortens in length so that the tail no longer overlaps the head.

The embryo then undergoes another change in orientation to assume the form characteristic of larva at hatching, figure 47 and 48.The embryo undergos a final rotation in which the bodturns through 180 along its longitudinal axis.

After the completion of this rotation and assumption of the coiled form, the embryo does not change its position again until hatching. Nearly same results were obtained by **Helal (1976**).



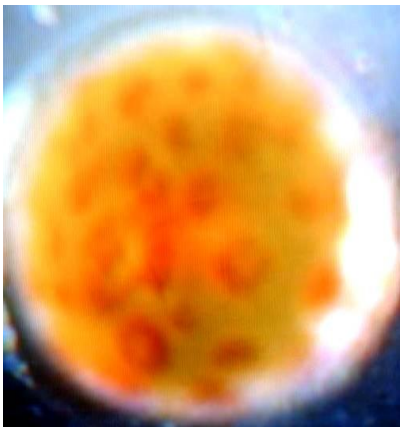


Figure 39 **Figure 40**

Figure 39&40: The future blastoderm nuclei have entered the cortical ooplasm

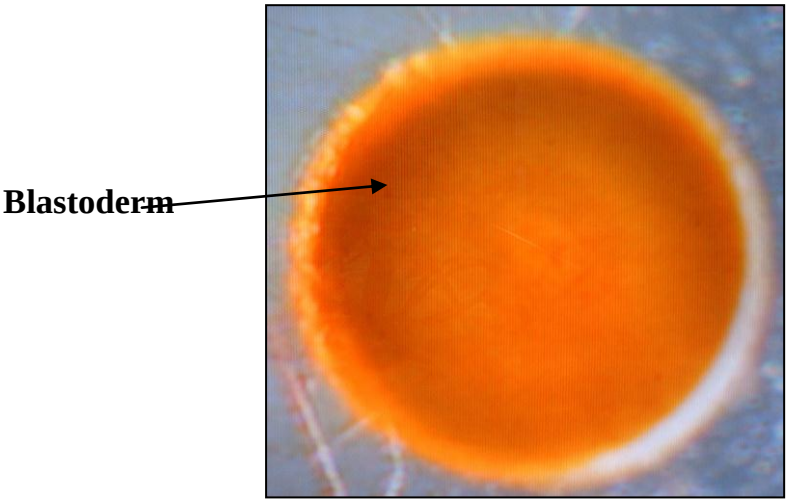


Figure 41: The blastoderm

The blastoderm was completed at about ten hours after oviposition.

Figure 42: The enterior end near the micropyle, is narrowing more rapidly than the posterior end and the head lobes are beginning to appear.

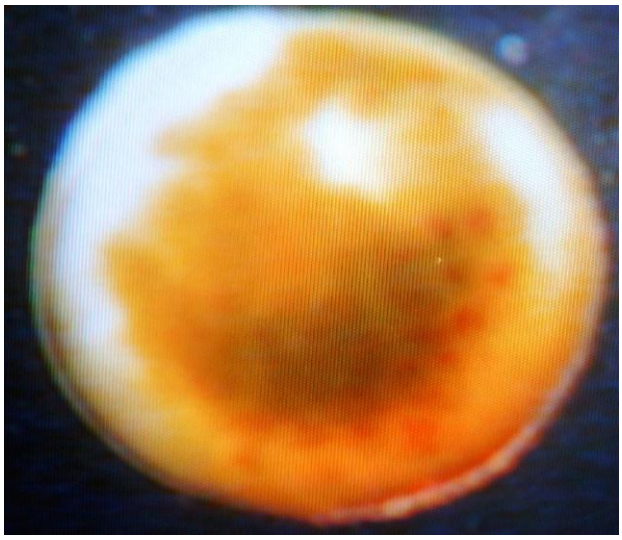


Figure 43: Cell proliferation from the germ band for forming the mesoderm

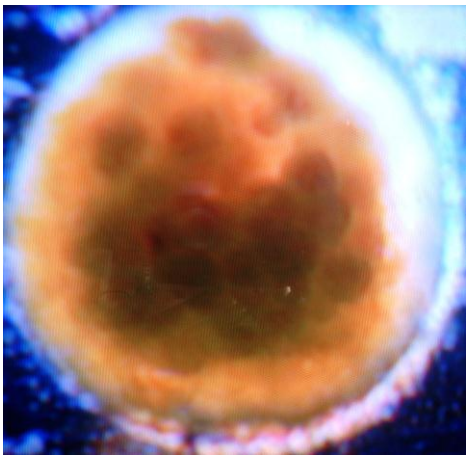


Figure 44

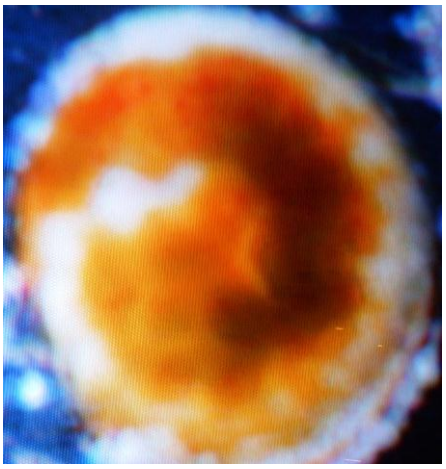


Figure 45

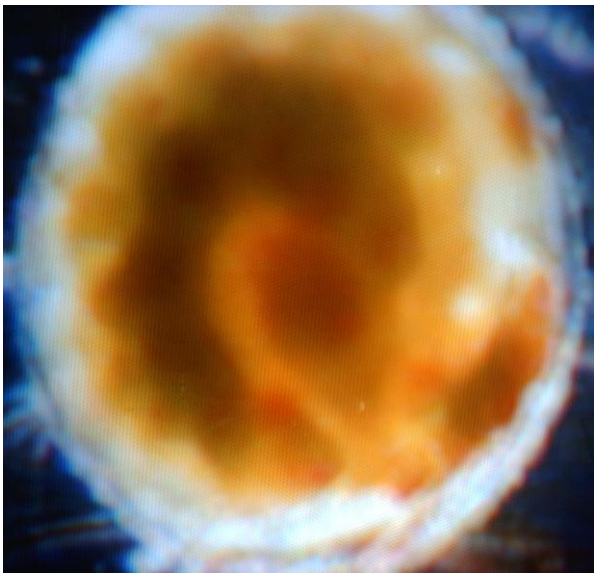


Figure 46

Figures 44&45 and 46: The development of a germ band of two definite layers, the ectoderm and mesoderm.

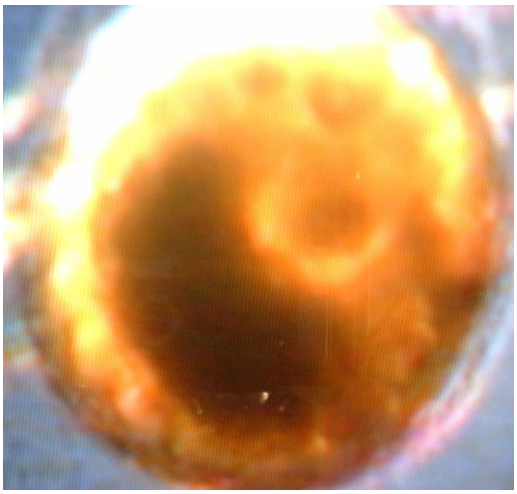


Figure 47

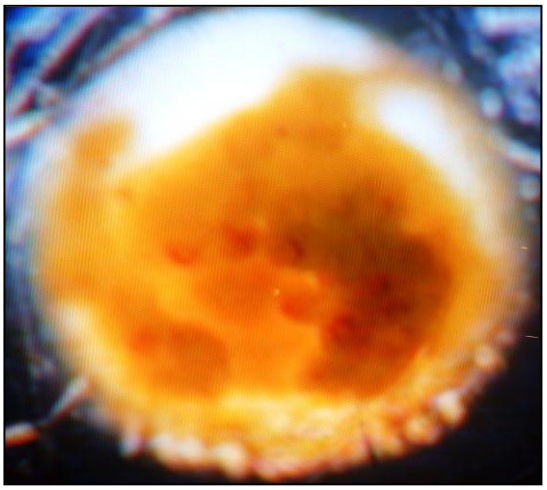


Figure 48

Figures 47&48: The embryo undergos a final rotation in which the body turns through 180 along tis longitudinal axis.

4.6.4-Bioactivety of some insect growth regulators on the embryonic development of the egg:

From the above results about the bioactivity of different tested compounds at different ages of the embryonic development it, seems clearly that JHAs compounds tested (fenoxycarb, pyriproxyfen amd diflubenzuron) have direct effect on the cleavage nuclei, on blastoderm and the germ band.

No remarcable, morphological changes were detected after treatment in cleavage nuclei or in blastoderm and on germ band.

Many authors, refered to same results. The researcher believes that maternal and zygotic genes which control subsequent development of the blastoderm and germ band were affected by JHAs compounds, while IGI compounds had no effect on these embryonic tissues.

IGI may have direct effect on ectoderm or endoderm or mesoderm as it is clear from the results. In this case the embryo was affected as it is possible to find some morphological changes in the embryo of the egg of age 24-48 hr.

The gradient factor. **(Novak, 1966 and 1968**), a factor necessary for growth (perhaps a part of the DNA molecule), whose inactivation leads to uneven growth, may be substituted by the JH. This would explain the progressing growth of certain embryonic structures at the time when normally they would disappear (abdominal coxopodites, ect.). Other results, e.g. inhibition of development in blastoderm, i.e. period when RNA synthesis begins **(Lockshin, 1966),** formation of the germ band,

segmentation, ect correspond rather with presumption that the JH have a certain part in the RNA production **(Odhiambo, 1966)**.

Of major importance is the discovery that both authentic and synthetic juvenile hormone-like compounds can block embryonic development as early as the blastoderm stage. This is true in hemipteran eggs **(Salama and Williams, 1966).**

Matolin (1973) studied the effect of JHA applied to the newly emerged females and to eggs after laying. He found that in the first case many eggs stop developing in cleavage division and a number of dwarf embryos were blocked in blastoderm, germ band and blastokinesis. The same author also found that the analogue was most effective after treatment in the first three days of embryonic development, later its effectiveness decreased. Histo auto-radiographic evolution showed the occurrence of the labelled JHA on the nuclear membrane of blastodermic cells. His results showed the observation of changes in embryogenesis is a very sensitive test for the evolution of effects of individual compounds. The present theories, assuming that the juvenile hormone analogues can block derepression, transcription or utilization of fresh genetical information, are supported by a finding that the JHAs block the activity of puffs of plyotene chromosomes.

Shalaby *et al.* (1987) studied histological examination on partly fresh eggs of *Spodoptera littoralis*, treated with, three concentrations (10, 100 and 1000 ppm) of CGA 29170, CGA 14715 and CGA 24477, indicated that the embryonic development was blocked at different stages of development according to the administred concentration. At the concentration

of 10 ppm, the embryogensis stopped not earlier than during elongation of the germ band perior to invagination of the caudal region, while treatment with 1000 ppm caused, in several cases, the presence of irregularly shaped cells scattered in the yolk, in others undifferentiated tissue were apparent.Administration of JH analogues to eggs, 48 hours after deposition did not affect the embryonic development in most cases, while some others had undifferentiat tissues.

Jacob and prabhu (1988) studied the effect of topical application of the juvenile hormone analogues, farnesyl methyl ether and kinoprene to eggs of *Dysdercus cingulatus* in the laboratory. Application immediately after oviposition, germ band formation and blastokinesis produced different types of abnormal embryos. Dose was generally correlated with mortality rate, kinoprene being more effective than farnesyl methyl ether. Embryonic mortality was similar following application just after oviposition or germ band formation, but less following applications immediately after blastokinesis. The neurosecretory index was higher in treated than in untreated embryos. Prothoracic glands and their nuclei were enlarged in treated embryos and continued development inside the chorion even alter untreated embryos had hatched. The corpus allatum was smaller in treated embryos and the corpora cardiaca were filled with neurosecretory material. Cuticle development was abnormal after treatment.

Fenoxycarb exhibited embryocidal activity against eggs in early blastoderm formation blastokinesis, and advanced larval development up to hatching. The ovicidal effect of fenoxycarb

was not restricted to any specific developmental stage of embryogenesis, and no significant relationship was found between duration of exposure and lethal or inhibitory effect, **Marchiondo *et al.* (1990).**

Applications of IGRs after blastokinesis often have resulted in delayed effects in further ontogenesis, e.g., the occurrence of extra larval or pupal instars similar to those obtained by contemporaneous JH applications in the last larval instar **(Masner *et al.* 1968; Riddiford, 1970, 1971**)

Edomwande *et al.* (2000b) studied the activities of the chitin synthesis inhibitor, lufenuron against embryonic and post embryonic stages of the American bollworm. The reported that although lufenuron had no effect on the development of the embryos, its larvicidal activities could help in reducing the damage caused by the American bollworm.