TABLE I

Synopis of some morphological characteristics of C. nardus *studied by different authors*

Sl. No.	Characteristics	Author's observation	Stapf, 1906	Bor, 1953
1.	Nature of spikelets pair	Each pair consists of a sessile and a pedicelled spikelet. Lowest pair of the sessile raceme homogamous, male. The rest of the pairs homogamous and hermaphrodite while the terminal triplet often heterogamous. If so then only two spikelets of the triplet are hermaphrodite while the third pedicelled spikelet is only unisexual and male.	Each pair consists of a sessile and a pedicelled spikelet. Lowest pair of the spikelets in each raceme or in the sessile raceme homogamous, neuter or male. The rest of the pairs of each raceme, including the terminal triplet, are homogamous, male or neuter.	Each pair consists of a sessile and pedicelled spikelet. Lowest pair of spikelets in the subsessile raceme homogamous, male or neuter. The remaining pairs of spikelets in both racemes heterogamous.
2.	Sessile spikelets	Lanceolate, awnless, upper lemma with a rudimentary awn in the sinus; lower floret empty and upper floret hermaphrodite.	Obovate lanceolate, awnless; upper lemma with a minute point or a very fine and short bristle from the sinus; florets unisexual, male or imperfectly developed.	Oblong lanceolate, awnless; upper lemma cleft to the middle into two lobes, awnless; lower floret empty and upper floret hermaphrodite.
3.	Pedicelled spikelets	Lanceolate-acute; florets hermaphrodite or unisexual; lower floret empty; upper floret hermaphrodite or unisexual, if so then only male	Lanceolate-acute; florets unisexual, male or imperfectly developed.	Elliptic oblong-acute in out line; florets unisexual or neuter, lower floret empty and upper floret unisexual and male.

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EFFECT OF INSECT GROWTH REGULATOR ON THE PHENOTYPIC CHANGES IN TROPHIC ORGANS OF CATERPILLARS OF *SPODOPTERA LITURA* FB. (NOCTUIDAE : LEPIDOPTERA)

Abstract

THE insect growth regulator, the Altosid at various doses induced the production of supernumerary instar in *Spodoptera litura*. The superlarvae which did not feed further showed varied degrees of deformities in the mouth parts. The extent and degree of deformities observed are presented in this note.

Introduction

Control of insects by manipulation of growth and differentiation with the use of hormones has attracted much attention in recent years due to their specificity and having no direct effect on the environment. The potentialities of juvenile hormone and their synthetic analogues in the suppression of populations of injurious insects have been well documented[10]. The exogenous application of insect juvenile hormone analogues (JHA) at critical periods of growth of an insect, turns off the differentiation factors[6] and results in the production of supernumerary instars. As no information is available on the morphology of mouth parts of supernumerary larvae formed as a result of treatment with insect juvenile hormone analogue, the present investigations were made with the tobacco caterpillar *Spodoptera litura* and the results are presented in this paper.

Materials and Method

The tobacco caterpillars used in the present investigation were reared on castor been leaf at 31° ± 2° and 10 hours day light[11]. The doses *viz.*, 1, 10, 20, 40, 80 and 100 µg. per larva of Altosid [Isopropyl (2E, 4E)-11-methoxy-3, 7, 11-trimethyl-2-4-dodecadionate, Zoecon Corporation, U.S.A.] applied topically to freshly moulted last instar caterpillars as described by Sundaramurthy[12]. A total of 75 caterpillars were treated with each dose. The treated caterpillars on eclosion into superlarvae were isolated and were given fresh leaf. A minimum of 10 superlarvae which did not proceed further with feeding after the initial exploratory bite, were killed and used for studying morphological changes in the mouth parts.

Results and Discussion

The head of normal last instar caterpillar is elliptical and compressed cephalocaudally with appendages typical to larval form. The treatment with JHA imposed various degrees of hypertrophy without altering the basic structure of head capusle. However, the head of superlarvae was 44% broader and 15% longer than the head of 6th instar larvae (Table I) with unsegmented, exceptionally enlarged and heavily sclerotized mass of antennae devoid of sensilla. The labrum, mandibles and maxillo-labial complex were also several times broader and longer than the 6th instar larvae. The incisors of mandible of superlarvae had a number of lateral serrations which were not usually present on the incisors of mandibles of 6th instar larvae. The maxillo-labial complex is the part which had severely undergone hypertrophy. The maxillary lobe was indistinctly segmented, heavily sclerotized mass, tapered distally to form a knob-like structure, on which seated the accessory lobes. The sensory setae were dispositioned on the knob. The basal segments of labial palpi were much enlarged and sclerotized. The sclerotization has extended up to the hypopharyngeal region and made the latter inconspicuous one.

The various degrees of hypertrophy observed in the mouth parts of superlarvae suggest that the juvenoids

TABLE I

Effect of insect growth regulator on the morphometric characters of mouth parts of larva of S. litura*

Character		6th Instar caterpillar	Super-larva	S.Ed.
Head	Width	2·74 mm	4·19 mm	0·230
	Length	3·00 mm	3·55 mm	0·488
Antenna	Width	0·05 mm	0·34 mm	0·306
	Length	0·02 mm	2·23 mm	0·279
Labrum	Width	0·95 mm	1·10 mm	0·165
	Length	0·70 mm	0·96 mm	0·052
Mandible	Width	0·60 mm	0·78 mm	0·042
	Length	0·90 mm	1·21 mm	0·063
Labium	Width	1·50 mm	2·10 mm	0·082
	Length	1·08 mm	1·94 mm	0·069
Labial palpi	Width	0·05 mm	0·40 mm	0·422
	Length	0·10 mm	0·75 mm	0·108
Maxillary-palpi	Width	0·20 mm	0·43 mm	0·048
	Length	0·40 mm	1·45 mm	0·172

* Mean of ten observations.

by their possible ecdysotrophic action[3], might have either proliferated the cells and stimulated the differentiation of tissues or increased the size of the cells by the process of eversion[8]. It has also been reported that stability of phenotype[9], development of cuticular structures[2] and growth rate of antennae[7] are governed by genes. The expression of genes has also been known to be affected by juvenile hormone analogues[1]. The loss of certain structures and abnormal development of certain other appendages of the mouth parts suggest that juvenoids might have affected the expersion of genes or transcription machinery[13], so as to effect a change in the phenotype of mouth parts.

The caterpillars with the mouth parts having these changes did not feed and the feeding inhibition might be due to the absence of antennal sensilla, expositioned sensory structure on maxilla and obliterated hypopharynx. These structures have been known to be involved in recognition of host[5] and in the process of continuous feeding[4]. The abnormal development of appendages of mouth parts and development of subdenticules on the incisors present in the mouth parts of superlarvae besides affecting the co-ordination in their functions, might have blocked the inflow of informations to CNS and thereby deterred the feeding by affecting the final motor behaviour.

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MODE OF POLLINATION AND FREQUENCY OF MUTATIONS IN SUNFLOWER (*HELIANTHUS ANNUUS* L.)

IN mutation breeding endeavours, generally all the plants are selfed in M_1 generation, so as to recover the recessive mutations induced in M_2 generation itself (Gaul[4]). This investigation was particularly designed to study the effects of mode of pollination in M_1 generation, on the frequency of mutations to be recovered in subsequent generations, about which hardly any attempt is made, so far.

A highly cross pollinated and commercially important crop such as sunflower (*Helianthus annuus* L.) was chosen for the study. The dry seeds of four sunflower varieties, *viz.*, (i) VNIIMK (EC-68413), (ii) Peredovik (EC-68414), (iii) Armavirskij (EC-68415) and (iv) Armavertzs (EC-69874) were irradiated with 20, 30 and 40 Kr. of gamma rays. M_1 generation was raised during summer 1974. The M_2 generation was grown on plant to progeny row basis. The chlorophyll mutations were scored in the first month of sowing and the other viable mutants were scored throughout the period of M_2 generation. Mutation frequency was worked out as percentage of M_2 segregating family, as well as the number of mutations per 100 M_2 seedlings.

Being a cross pollinated crop, seed setting on selfing in sunflower is very poor. Therefore, to have equal number of M_2 seeds both under selfed and open pollinated categories, 75% of the heads in all the treatments were cloth bagged to ensure self-pollination and 25% of the plants were left as such for open pollination.

It was observed (Tables I and II) that in the progeny of selfed plants, the frequency of abnormal and drastic mutations was considerably higher than that in the progeny of open pollinated plants. This may be due to the expression of induced recessive mutations, in addition to dominant mutations, on selfing, while only dominant mutations induced were expressed in the progeny of open pollinated plants.

TABLE I

Frequency of chlorophyll mutations in M_2 generation as affected by mode of pollination in M_1 generation

Mode of pollination in M_1 generation	Frequency on M_2 family basis (per cent)	Frequency on M_2 seedling basis (per cent)
Selfed	4·76	0·48
Open pollinated	3·27	0·33

TABLE II

Frequency of viable mutations (excluding chlorophyll mutations) in M_2 generation as affected by mode of pollination in M_1 generation

Mode of pollination in M_1 generation	Frequency (per cent)
Selfed	1·83
Open pollinated	1·33

Another reason for this observed phenomenon could be the operation of inbreeding depression, in the progeny of selfed plants. Selfing in cross pollinated plants leads to inbreeding depression (Shull[6] and Jenkins[5]) which is manifested as the appearance of large number of lethal, abnormal and sub-vital