enhanced the length and reversed the suppression. As early as 1903, Loew\textsuperscript{8} suggested that Ca neutralizes the toxic effects of single salts of Na, K and Mg and a certain ratio of Ca and Mg was necessary for the proper growth of plants. It is also known that certain combinations and ratios of salts or ions are more beneficial to plant growth than others.\textsuperscript{9-11} This is borne out from the data reported here. Beneficial effect of mixture of NaCl and CaCl\textsubscript{2} may be attributed to the fact that NaCl increases succulence and hydration, while Ca is a constituent of middle lamella of cells and promotes root growth\textsuperscript{12}. When combined, there is increased hydration and availability of cell wall material; this results in the increased root length. Retardation of shoot length caused by individual salts is also reversed by the mixtures, perhaps the ratios 1:1 and 1:3 may balance the toxic effects of individual ions.\textsuperscript{8-10} Mg is required for rapid growth of young cells, high protein concentration and active mitosis, it is also an enzyme activator for carbohydrate metabolism and is associated, with the energy supplying phosphorus compounds.\textsuperscript{12} In combination with Ca any of the effects of Mg enumerated above may be stimulated or augmented and thereby, alleviate retardation by their individual toxic effect.

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A NOTE ON TOXICITY OF NICOTIANA GOSSEI DOM. TO THE LARVAE OF TOBACCO STEM BORER GNORIMOSCEMA HELIOPA LOW.

Many Nicotiana species have been reported to be resistant to various insect species. Thuret\textsuperscript{1} (1961)\textsuperscript{3} reported that \textit{Nicotiana gossei} Dom.; \textit{N. rependa} Willd.; and \textit{N. trigonophylla} Dom. were highly resistant to green peach aphids. Parr and Thurston (1968)\textsuperscript{3} have reported the toxicity of \textit{Nicotiana gossei} to the larvae of tobacco hornworm \textit{Manduca sexta} Joh. Burk and Stewart (1969)\textsuperscript{3} also have reported the resistance of \textit{Nicotiana gossei} to green peach aphids. The toxicity of \textit{N. gossei} to green peach aphids (\textit{Myzus persicae} Sulz.) and first three instar larvae of tobacco leaf eating caterpillar (\textit{Spodoptera littura} F.) in the laboratory was reported from C.T.R.I. (Anonymous, 1972-73).\textsuperscript{1} In India, the tobacco stem borer \textit{Gnorimoschema heliopa} Low is a serious pest on Virginia, bidi and other types of tobacco. Hence in the present investigation \textit{Nicotiana gossei} which has been reported toxic to various insects has been screened for resistance to \textit{G. heliopa} Low in the laboratory.

The culture of \textit{G. heliopa} was maintained in the laboratory. \textit{Nicotiana gossei} and \textit{N. glauca} Grah. used in the test were grown in the glass house; the latter species was used as non resistant check. Five freshly laid eggs of \textit{G. heliopa} were transferred to the tender leaf. Five plants of both the species of \textit{Nicotiana} were used for testing. After the eggs hatched, daily observations on feeding of first instar larvae and their survival were recorded. The trial was repeated after about 15 days of completion of the first trial.

Observations indicated that the eggs hatched within 3 days. Immediately after hatching, the larvae start crawling on the trichomes and nibbling the leaf tissue. The larvae feed on the epidermis of the leaf tissue of \textit{N. gossei} (Fig. 1). All the twenty-five larvae that hatched on \textit{N. gossei} showed nervous convulsions and morbidness within 24 hours. They dehydrated very

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FIG. 1. Epidermal feeding of first instar larva of \textit{G. heliopa} L. on \textit{N. gossei} D., × 50.
rapidly and became brittle after death. Against this, the larvae fed profusely on *N. glauca* and developed fully. Similar results were obtained when it was repeated for a second time in the laboratory with the same number of *G. heliope* eggs per plant. These observations clearly indicate that *N. gossiei* is highly toxic to first instar larvae of *G. heliope*; thus serving as a good source of resistance to tobacco stem borer.

All India Co-ordinated Research Project on Tobacco of I.C.A.R. at Gujarat, Agricultural University, Anand Campus, Anand, May 9, 1975.


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**INTERACTION BETWEEN CYCOCEL AND GIBBERELLIC ACID IN POLLEN TUBE ELONGATION OF CALOTROPSIS PROCERA**

Recently, the effect of various growth regulators, e.g., abscisic acid (ABA), cycocel (CCC), gibberellic acid (GA$_3$), indole acetic acid (IAA) and kinetin (K) on pollen tube elongation was studied by us. It was observed that IAA and CCC inhibited the elongation of pollen tubes while the rest of the growth substances regulated additional elongation. Interaction between these growth substances in respect of tube elongation was also studied. When used in combination, some of these growth regulators exhibited synergism, (e.g., CCC + GA$_3$). Present studies describe this interaction.

Pollinia were dissected out from the flowers of *Calotropis procera* and incubated in 15% sucrose medium in cavity slides. Different concentrations of cycocel (CCC) and gibberellic acid (GA$_3$) were maintained in 15% sucrose as a basal medium under constant illumination from a light bank of two 40W fluorescent lamps at a distance of 1 meter. The controls were maintained in a basal medium excluding these compounds. Incubation was carried out at 28°C ± 2°C for a period of 4 hours. In each culture, 3 pairs of pollinia were incubated and 3 replicates were run in each treatment. Mean length of 20 pollen tubes was recorded for each treatment, and on the basis of results obtained, standard deviation was calculated.

When CCC was applied to the pollinium, it retarded the elongation of pollen tubes. However, GA$_3$ at 10 ppm enhanced the growth of the tubes to the maximum. Higher concentrations of GA$_3$ did not produce a linear response (Table I). An

**Table I**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Length of P.T. (μ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCC</td>
<td>GA$_3$</td>
</tr>
<tr>
<td>10a</td>
<td>380±10.9</td>
</tr>
<tr>
<td>25a</td>
<td>325±10.6</td>
</tr>
<tr>
<td>10</td>
<td>570±19.2</td>
</tr>
<tr>
<td>20a</td>
<td>490±15.2</td>
</tr>
<tr>
<td>10b</td>
<td>366±10.9</td>
</tr>
<tr>
<td>20b</td>
<td>480±7.4</td>
</tr>
<tr>
<td>10a</td>
<td>425±7.95</td>
</tr>
<tr>
<td>25+</td>
<td>1100±46.1</td>
</tr>
<tr>
<td>Control</td>
<td>452±15.5</td>
</tr>
</tbody>
</table>

The concentrations are given as ppm
(a) 4 h of treatment.
(b) 1 h of pretreatment, 3 h post-treatment.

attempt was made to examine the interactive effects of GA$_3$ and CCC in relation to pollen tube elongation. Interestingly enough, combined application of the two had evidently additive or synergistic effect, resulting in more growth than the controls, or when either compound especially GA$_3$ was used. The maximum elongation was obtained with the optimum proportions of GA$_3$/CCC in the mixture as 10/25 ppm (1100 μ) or 25/5 ppm (960 μ). Even proportions such as 5/5 (690 μ), 10/10 (760 μ), 25/10 (730 μ) produced greater elongation of pollen tubes. The elongating effect of GA$_3$ is known in many plant organs (Audus, 1972). It is widely known that GA$_3$ reverses the retarded growth caused by many retardants, except in barley endosperm test, where Briggs (in Audus, 1972) failed to antagonise the effect of GA$_3$ by cycocel. It is widely known that CCC acts at the level of gibberellins biosynthesis. The fact that cycocel, in the manner of an 'antigibberelline', suppressed the elongation of tubes, strongly suggested that native gibberelline(s) existed and/or were biosynthesised during the germination of pollen tubes under natural conditions. Our present studies also show that the post-treatment with exogenous GA$_3$ restored the retarding effect of CCC. In addition, when used in combination, tube growth also increased. Obviously, this was because of synergism between CCC and GA$_3$. We suggest