At the 20th day from the collection, total number of larvae grown up on each fruit was counted and recorded. Although a small numbers of *C. capitata* grew up also on the materials, these flies were not counted in the present experiment.

Number of apricot samples for the present observation were sufficiently numerous, $N=116$. The infestation of the flies was not heavy and the maximum infestation was 12 individuals per fruit. Therefore, it was possible to score the number of apricots into the observed frequency as shown in the first and second columns of Table 1. Here, x is the number of flies per fruit and f is the number of fruits observed. The total number of flies was $\Sigma(fx)=240$ and the average $\bar{x}=2.0690$. The variance $s^2=5.4909$ was 2.65 times as large as the mean. The over-dispersion of the flies on the fruits was proved by the significance of discrepancy which was tested by comparing $\chi^2=305.20$ with $n=115$ degrees of freedom, P_r was less than 0.001. Although the several mathematical models have been proposed for the over-dispersion, the negative binomial is the easiest to compute and the most widely applicable distribution. The experimental result fitting the negative binomial was shown in Table 1. A positive exponent $\hat{k}$, which is a measure of dispersion, was computed with the formula $\Sigma\{Ax/(\hat{k}+\bar{x})\}-N\ln(1+\bar{x}/\hat{k})=0$. (Bliss, 1953; Nagasawa et al., 1968). As is seen in the last line of the table, the P_r of χ^2 test for the discrepancy between the observed and expected frequencies indicates the good agreement to the negative binomial.

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Digestive Enzymes of Sugarcane Leafhopper, *Pyrilla perpusilla* Wlk. (Fulgoridae: Hemiptera)[1]

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Sugarcane is profusely attacked by the leafhopper, *Pyrilla perpusilla* Wlk. Its nymphs and adults suck sap from the sugarcane leaves and thus weakens the plant and reduce its sucrose contents. Gupta and Avasthy (1960) have reported as much as 50% decrease in the sugar and *gur* (jaggary) in the epidemic outbreaks. In the recent years the hopper has been observed to migrate to some other crops also, particularly to the wheat crop. The utilization of carbohydrates and proteins depends on the presence of the different carbohydrases and proteases and therefore a study of these enzymes in the gut of the adult hopper has been made.

The nymphs and adults were collected from the infested fields of sugarcane in the vicinity of Lucknow by net-sweeps, and were released into the wire-gauze cages having healthy sugarcane leaves dipped in 5% sucrose solution. To dissect out the alimentary canal the insects were immobilized by chilling them in a freezer (−10°C) for about 10 min. The entire alimentary canal was taken out in ice-cold Ringer solution and the adhering tissues were removed from it. The guts of 15 adults (males or females) were homogenized in 0.5 ml of distilled water. The homogenate was centrifuged at 3,000 $\times g$ for 15 min. The volume of the supernatant was brought to 1.0 ml by adding distilled water. This was used as enzyme source. The reaction mixture contained 0.5 ml of 0.1 M phosphate buffer (pH 7.5, i.e. pH of the gut homogenate), 0.5 ml of 1% substrate, 0.5 ml of enzyme extract and a few drops of toluene. In the control mixture all the above-mentioned ingredients were present, the difference was that the enzyme was denatured by boiling the enzyme extract. Both the mixtures were incubated at 37°C for 24 hr (144 hr in the case of cellulase test). After incubation the hydrolytic products of the reaction and control mixtures were identified by chromatography. The presence or absence of the hydrolytic products indicated the presence or absence of the enzyme tested. Trypsin-like activity was tested by the method of Siegelman et al. (1962). The hydrolytic products produced by carbohydrases were detected by unidimensional descending paper chromatography using Whatman

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Table 1. Digestive Enzymes in the Gut of *Pyrill perpusilla*

Enzyme tested	Substrate used	Products of hydrolysis detected	Activity
I. Carobohydrases			
1. Amylae (3.2.1.1)	Soluble starch[a]	Maltose, Glucose	+
2. Cellulase (3.2.1.4)	Filterpaper pulp[b]	—	−
3. α-Glucosidases			
i. Maltase (3.2.1.20)	Maltose[a]	Glucose	+
ii. Melezitose	Melezitose[a]	Fructose, Glucose	+
iii. Sucrase (3.2.1.26)	Sucrose[a]	Fructose, Gluctose	++
iv. Trehalase (3.2.1.28)	Trehalose[a]	Glucose	+
4. 1-Glucosidase (3.2.1.21)	Cellobiose[a]	Glucose	+
5. α-Galactosidase (3.2.1.22)	Melibiose[a]	Galactose, Glucose	+
6. β-Galactosidase (3.2.1.23)	Lactose[a]	—	−
7. β-Fructosidase (3.2.1.80)	Raffinose[a]	Fructose, Galactose, Glucose	+
II. Proteases			
1. Trypsin (3.4.4.4)	TAME (p-tosyl-L-arginine methyl ester)[c]	Methanol	+
2. Aminopeptidases			
i. Aminotripeptidase (4.3.1.3)	L-leucyl-glycylglycine[d]	Glycine, Leucine	+
ii. Leucine aminopeptidase (3.4.1.1)	L-leucyl-glycine[d]	Glycine, Leucine	+
3. Carboxypeptidase (3.4.2.1)	Chloroacetyltyrosine[d]	Tyrosine	+
4. Dipeptidases			
i. Prolinase (3.4.3.6)	K-prolyl-glycine[d]	Glycine, Proline	+
ii. Prolidase (3.4.3.7)	Glycyl-L-proline[d]	—	−
iii. Glycyl-L-leucine dipeptidase (3.4.3.2)	Glycyl-L-leucine[d]	Glycine, Leucine	+
iv. Glycyl-glycine dipeptidase (3.4.3.1)	Glycyl-glycine[d]	Glycine	+

[a] Khan and Ford (1967)
[b] Hawk et al. (1947)
[c] Siegelman et al. (1962)
[d] Colwick and Kaplan (1955)

− Activity absent
+ Activity present
++ Very high activity present

No. 1 paper, iso-propanol: water (4 : 1, v/v) as the developing solvent and Benzidine reagent (Smith, 1960) as the visualizing agent. The hydrolytic products produced by peptidases were detected by unidimentional ascending thin-layer chromatography using Silica Gel G as the adsorbent, phenol: water (4 : 1, v/v) as the developing solvent, and 0.2% ninhydrin in water saturated n-butanol as the visualizing agent.

In the gut of *P. perpusilla* almost all kinds of carbohydrases have been detected (Table 1). Among these sucrase appears to be of greatest importance since the hopper's food contains only sucrose among the digestable carbohydrates. The activity of sucrase is very high as compared with other enzymes in the hopper. These observations confirm the view of House (1965) that the predominant presence of an enzyme in an insect gut at least suggests that its diet abudantly contains the corresponding substrate.

The presence of amylase in the gut of the hopper appears to be not much importance as long as it feeds on the sugarcane leaves in which starch is practically absent. Presence of meltase in its gut may be considered as the part of the enzyme system present for the digestion of starch, and thus enabling it to secure nutrition from other plants at the time when there is scarcity of the normal host plant.

Among the proteases, trypsin, carboxypolypeptidase, aminopeptidases, prolinase, glycyl-L-leucine

dipeptidase and glycyl-glycine dipeptidase are of great importance as they help to upgrade the availability of absorbable nitrogenous raw materials. It has been observed that when sugarcane is manured by nitrogenous fertilizers, it becomes more prone to the attack of the pests including the leafhopper. It appears that availability of absorbable nitrogenous raw materials acts as a limiting factor in the population growth of the hopper.

The presence of a wide varity of carbohydrases and proteases in the gut of the hopper normally not required, may relate either to its ancestral habits in its phylogeny or to its expansible capacity yet unexploited. The mechanisms of this sort are wide-spread in insect which enable them to adapt to adverse and diverse nutritional conditions. The enzymatic system, for the digestion of food in the hopper, suggests that it may be able to fulfil its nutritional requirements from the wheat plants.

In short, the activities of amylase, α-glucosidases (maltase, melezitase, sucrase and trehalase), β-glucosidase, α-galactosidase, β-fructosidase, trypsin carboxypolypeptidase, aminotripeptidase, leucine aminopeptidase, prolinase, glycyl-L-leucine dipeptidase and glycyl-glycine dipeptidase were detected in the gut of *P. perpusilla*. The enzymatic system of the hopper suggests that it may become a serious pest of wheat plants on which it has been reported recently.

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