(39.0 and 62.5%) and permethrin (36.2 and 46.9%). During the experiments, cypermethrin exhibited the highest deterrent effect against all the tested mosquito species, whereas the minimum was observed in the case of permethrin. The order was—cypermethrin (64.8%) < fenvalerate (53.6%) < decamethrin (46.1%) < permethrin (38.9%).

During the experiments, different numbers of females were found lying dead in the bowls, which might be due to the knockdown effect of these insecticides. Maximum number of females were found dead in decamethrin-treated oviposition solution, followed by cypermethrin, permethrin and fenvalerate. The females found trapped in the bowls were dissected to ascertain the time of their death, and the dissection results exhibited the presence of eggs in the abdomen of some of the females.

These laboratory evaluations, of synthetic pyrethroids, as repellent, against common mosquito population warrant a field trial to understand its vital role in control of adult mosquito population.

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OUTBREAK OF *BISTON REGALIS* MOORE (GEOMETRIDAE, LEPIDOPTERA) ON BLUE PINE (*PINUS WALLICHIANA*)—A NEW RECORD

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A NUMBER of species of *Biston* have been reported in literature as pests of apple and other fruit and forest trees[1–3]. The biology of *Biston hirtaria* has been studied[4,5] and its outbreaks reported in other parts of the world[3,5,6]. A serious outbreak was reported in apple orchards in USSR in 1974–75[6].

B. regalis was never reported as a serious agricultural or forest pest in Pakistan before 1980. In August 1980 a severe epidemic was observed for the first time on blue pine in Danna and Loon Bangla areas. Larvae were feeding on the bases of needles causing them to fall off and resulting in defoliation. The pest had defoliated hundreds of hectares of forest up to September. Forest gave an appearance of fire damage from a distance. Larvae mainly fed on blue pine but were also found on *Xylosoma* sp., *Vibernum* sp., *Berbaris* sp., *Nerium* sp., wild rose, apple, and walnut.

Pupation started in mid September. Pupal population was estimated in October. On an average 21 dark brown pupae were found in one m^2 at a depth of 5–15 cm. Pupal population was higher near the tree bases. The insect overwintered in pupal stage and emergence in laboratory started in April. Mating started immediately after emergence. Egg laying started after 4–5 days after mating and a single female laid 1500 eggs. Further biological studies are being done by the Pakistan Forest Institute, Peshawar.

As some of the related species are known to feed on fruits and crops, feeding tests were done with pear, apple, plum, maize, and rice in 1980. Larvae fed only on pear and apple. During 1981 another study was conducted with full grown larvae in captivity using the plants which are common crops or fruits produced near forest area at those locations. Larvae were allowed to feed on excised leaves, which were changed every day, for a week. Consumption was recorded and computed to leaf area consumed/day. The data are presented in table 1.

Consumption was quite high on soybean, mash, and pear. Consumption between fruits and pulses was not compared due to the difference in their leaf thickness

Table 1 *Consumption of different plants by Biston regalis.*

Host Plant	Family	Consumption (mm^2)
Fruit trees		
Apple (*Pyrus malus*)	Rosaceae	5.87
Pear (*P. communis*)	–	93.33 a
Plum (*Prunus domestica*)	–	19.50 c
Quince (*Cydonia oblonga*)	–	29.79 b
Guava (*Psidium guajava*)	Myrtaceae	31.83 b
Pulses		
Beans (*Phaseolus vulgaris*)	Papilionaceae	0.00
Mash (*P. mungo*)	–	164.50 b
Soybean (*Glycine max*)	–	239.55 a
Cowpeas (*Vigna unguiculata*)	–	34.99 c

P = 0.05

as consumption was based on leaf area eaten and not on the weight. All these plants can serve as potential host of the pest.

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VARIATION IN THE SACCHARIDES IN THE HAEMOLYMPH OF *CHILO PARTELLUS* (LEPIDOPTERA : PYRALIDAE) DURING GROWTH AND DEVELOPMENT

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THE biochemical changes associated with metamorphosis in Holometabolous insects have earlier been reviewed[1,2]. These studies suggest that carbohydrates and lipids are the primary energy reserves for these events. The haemolymph sugars differ greatly in different insects. Various workers have given comprehensive details of the carbohydrates and their metabolism in insects[3,4]. In view of the fact that the carbohydrate content varies during the development of an insect a study was initiated to note the day-to-day variations in the haemolymph glucose and Trehalose during the development in *Chilo partellus*.

The stem borer *Chilo partellus* is the most destructive pest of *Sorghum vulgare* Pers (jowar). For experimental purpose the above insect was reared in the laboratory on artificial diet[5] at a temperature of 27 $\pm$ 1°C and rh 65 $\pm$ 5%. Haemolymph from the larvae, pupae and adult was collected using the rapid centrifugation method[6]. To inhibit the tyrosinase activity of the haemolymph, phenyl-thio-urea was added to it. The haemolymph was centrifuged at 2500 rpm to remove haemocytes. The glucose content of the haemolymph after deproteinization was determined by anthrone reagent[7] using d-glucose as standard and expressed in g/100 ml of haemolymph.

Trehalose in the haemolymph extracts was separated by thin layer chromatography. The haemolymph (20 μl) was applied on the chromoplates which were developed using the solvent system *n*-butanol-acetic acid-water (4:1:1 v/v). Trehalose was detected with an alkaline solution of silver-nitrate[8] comparing R_f values of sugar spots with those of trehalose standard.

A gradual rise in the concentration of haemolymph glucose from 4.4 $\pm$ 0.1 g/100 ml in the first instar larvae to 4.6 $\pm$ 0.04 g/100 ml in the second instar larvae was observed. The glucose concentration in the haemolymph recorded a further increase to 5.2 $\pm$ 0.01 g/100 ml in the third instar larvae. The increase in the glucose level was simultaneous with increase in the body weight of the larvae. On the 12th day of the life cycle *i.e.* the last day of the third instar larvae the glucose concentration in the haemolymph reached a value of 5.7 $\pm$ 0.06 g/100 ml. There was a rapid increase in the haemolymph glucose level in the fourth instar, the glucose level increased by 3 g/100 ml reaching a level of 8.6 $\pm$ 0.02 g/100 ml on the last day of the fourth instar *i.e.* on the 20th day of the life cycle.

A further increase was recorded from the early fifth instar larva to the end of this larval stage. The increase was from 9.2 $\pm$ 0.08 g/100 ml to 14.3 $\pm$ 0.03 g/100 ml.

In the pupal period a decrease was however noticed throughout, this being the non-feeding phase of the life cycle. The recorded values are 14.8 $\pm$ 0.06 g/100 ml on