PESTS OF MAIZE AND THEIR MANAGEMENT
IN HIMACHAL PRADESH - A REVIEW

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ABSTRACT

Thirty-one pests have been listed to cause variable damage to maize under field and storage conditions. Under field conditions, the crop is damaged by soil dwellers, foliage feeders, stem borers, flower feeders and cob feeders. Under storage conditions, maize grains suffer heavy loss due to rice weevil, khapra beetle, lesser grain borer and angoumois grain moth. Rats are menace under poor storage conditions. Management strategies for different pests are discussed.

Maize is one of the most important "kharif" crops in Himachal Pradesh. The total area under this crop in the State is 319.1 thousand hectares with the production of 655 thousand tonnes (average yield of 20.5 q/ha) which is next to the area under wheat (Anonymous, 1993). This crop with its many phases of production and utilization under different environmental conditions presents many interrelated problems in which insects are commonly involved. In one way or another, maize is subjected to insect attack from the time it is sown until it is consumed as a food or feed. Other crops particularly with small grains, forage, grasses and legumes frequently are sources of insects that attack maize and must be considered as part of the maize-pest problem.

Maize in the state is attacked by a number of insects which cause variable economic damage (Sharma and Bhalla, 1964). Kakar et al. (1987) listed 17 species of insects and non-insect pests infesting maize under field conditions in the State. The objective of this review is to present more significant information on the insects and non-arthropods that are troublesome on maize crop in the field and in storage and steps taken for their successful management in Himachal Pradesh.

Pest Status

The newly introduced high yielding varieties/hybrids and heavy application of fertilizers provide luxuriant growth to maize crop which attract a number of insect and non-insect species in comparison to local cultivars. However, only a few attain the pest status under ambient climatic conditions. A comprehensive list of the insects and non-insect species found damaging maize in Himachal Pradesh has been given in Table 1.

Pest Management Strategy

Field crop pests: For the management of insect-pests of maize, IPM has to be adopted rather than to depend exclusively on chemical control.

For the control of soil dwellers, deep ploughing of fields and exposing the soil inhabiting larvae of different insect - pests few days before sowing to bird predators like Indian Myna, house sparrow, king crow and other birds is a cheap cultural method of control. Well-decomposed F.Y.M. should be used to avoid the multiplication of white grubs and termites. High seed rate should be used to compensate plant mortality due to severe damage by soil pests. To escape the incidence of soil pests, sowing period can be well adjusted e.g. early sown maize (20th May) in Kunihar area of Solan district has been found to escape the attack of black beetle and incidence decreases with delay in sowing (Kakar et al., 1978). Contrary, incidence of cutworms in lower Kullu valley has been noticed in early
sown maize (up to first week of June) and declined with the delay in sowing date (Anonymous, 1996-97).

In addition to above practices, methyl parathion (2% dust) or malathion (5% dust) @ 25-30 kg/ha should be mixed in soil at the time of field preparation or sowing. Thakur (1997) found aqueous root extract (0.5%) of 'Alberry' (Rumex nepalensis) as an effective treatment against black cut worm, A. ypsilon (Rottenburg).

### Table 1. Pests of maize in Himachal Pradesh

<table>
<thead>
<tr>
<th>Pest Type</th>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Pest Status</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>(A) Field crop pests</td>
<td>(1) Soil dwellers</td>
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<tr>
<td>(a) Cut worms</td>
<td>Agrotis spp.</td>
<td>Sporadic</td>
<td>Infest the crop at germination stage. A. ypsilon has been reported to cause severe damage to maize (23.92%) in Salooni area of Chamba district of Himachal Pradesh (Thakur and Kashyap, 1992) and early sown (up to first week of June) crop in lower Kullu Valley. (Anonymous, 1996-97).</td>
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<tr>
<td></td>
<td>A. ypsilon</td>
<td>(Rottenburg)</td>
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<tr>
<td></td>
<td>A. spinulera Hubni</td>
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<tr>
<td>(b) Black beetle</td>
<td>Heteronychus loideres Reld.</td>
<td>Sporadic</td>
<td>Recorded to cause severe loss in Kunihar area of Solan district (Kakar et al., 1977a); Infest the crop at germination upto 30 days; practically no damage is caused when plants attain a height of 30 cm. (Anonymous, 1996-97).</td>
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<tr>
<td>(c) White grubs</td>
<td>Hoplochiria spp. Maladera insanibils (Blanch)</td>
<td>Sporadic</td>
<td>Infest the crop at seedling stage. Recorded from maize fields at Bajaura (Kullu) (Kumar et al., 1996).</td>
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<td>(d) Termites</td>
<td>Odontotermes obsesus (Ramnur)</td>
<td>Sporadic</td>
<td>Present in lower areas of the state</td>
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<td>(2) Foliage feeders</td>
<td>(a) Grass hoppers</td>
<td></td>
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<td></td>
<td>(i) Chrotopogonus trachypterus Blanchard</td>
<td>Regular</td>
<td>Feed on foliage and soft stems of young maize plants</td>
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<td></td>
<td>(ii) Hieroglyphus nigroreplethus (Bol.)</td>
<td>Regular</td>
<td>- do-</td>
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<tr>
<td></td>
<td>Diacrisia obliqua Walker</td>
<td>Sporadic</td>
<td>Initially feed gregariously and are noticeable</td>
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<tr>
<td></td>
<td>Helicoverpa armigera (Hub.)</td>
<td>Sporadic</td>
<td>Feed on foliage during June-August in mid hill areas (Gupta et al., 1984).</td>
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<tr>
<td></td>
<td>BENOSIA overlata</td>
<td>Sporadic</td>
<td>Mostly found on lower altitudinal areas of Solan, Biaspur, Mandi, Kullu, Kangra, Hamipur and Una particularly when rains are continuous.</td>
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<tr>
<td></td>
<td>Terinites sp.</td>
<td>Sporadic</td>
<td>Serious pest in high rainfall areas of Banjar block (Libhi, Gada Gussain, Sainj etc.), Nagar block (Halan, Nagar, Kastain, Badesgran etc.) and Ani block (Kothi, Choi and Ani areas of Kullu district; Chhalchokw, Gohar, Pipiu and Luhara areas of Mandi district); predominant in areas between 1500 and 2100 m.a.s.l. (Anonymous, 1986-87)</td>
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<td></td>
<td>(ii) Macrochlamys Regular sp.</td>
<td></td>
<td>Serious pest in Gadagusaini, Jauli, Thachidhar, Mohini, Buchhut, Khargarah, Sajwar area of Kullu district; predominant in places above 2200 m altitude (Anonymous, 1986-87).</td>
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<td></td>
<td>Anadenus Regular altivagus Theobald</td>
<td>Regular</td>
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(Contd.
(3) Stem borer  | Maize stem borer  | Chilo partellus (Swinhoe)  | Regular  | It generally attacks the crop soon after germination and incidence becomes pronounced after 45 days of germination; infested plants show 'dead hearts'; no infestation recorded in areas above 1700 m.a.m.s.l.

(b) Pink borer  | Sesamia inferens (Walker)  | Sporadic  | - do-

(c) Shoot fly  | Atherigona naevii Steyskal  | Sporadic  | Recorded infesting young maize seedlings at Chambaghat and Nauni areas of Solan district; maggots infest maize seedlings of 3-4 leaf stage and no damage is caused to seedlings of 7-8 leaf stage (Kumar and Chander, 1984).

(4) Flower feeders  | Blister beetles  | Mylabris pustulata Thurb.  | Sporadic  | They appear at tassel stage and feed voraciously on the tassels and silk portion and sometimes cause loss to the crop (Sharma et al., 1964; Hameed et al., 1973).

(b) Maize stem borer  | Helicoverpa armigera (Hb.)  | Sporadic  | - do-

(c) Fruit borer  | Chilo partellus (Swinhoe)  | Sporadic  | - do-

(d) Maize aphid  | Rhopalosiphum maidis Fitch  | Regular  | Appear at the initiation of tasseling.

(5) Cob damaging pests  | Fruit borer  | Helicoverpa armigera (Hb.)  | Sporadic  | Bores into young developing cobs (Gupta et al., 1987)

(b) Maize stem borer  | Chilo partellus (Swinhoe)  | Sporadic  | - do-

(c) Blister beetles  | Mylabris spp.  | Sporadic  | Bores into the young developing cobs (Gupta et al., 1987)

(d) Parakeets  | Crows, Indian Myna  | Regular  | Feed on grains

(e) Jackals  | porcupines, wild pigs  | Regular  | Destroy the plants and feed on grains

(f) Rats  |  | Regular  | Destroy the root system of plants; dislodge them and then feed on grains.

(3) Storage pests  | Rice weevil  | Sitophilus oryzae L.  | Regular  | Both larvae and adults cause heavy damage particularly during monsoon; they destroy more than what they eat.

(2) Kharra beetle  | Trogoderma granarium  | Regular  | Only larvae cause damage; they eat the grains near the embryo or any other week point and from there proceed inwards.

(3) Lesser grain borer  | Rhizopertha dominica F.  | Regular  | Both adults and larvae cause serious damage to the grains by feeding inside them and reducing them to mere shells with many irregular holes; when the infestation is severe, adults produce a considerable amount of frass, spoiling more than what they eat.

(Coast.)
For the management of foliage feeders, clean cultivation by removing weeds, ploughing and removing alternate hosts must be adopted. Bunds of fields must be cleared off from grasses/weeds and then dusted with methyl parathion (2%) or malathion (5%) @ 25-30 kg/ha since these are the breeding places for grass hoppers. Larvae of hairy caterpillars and fruit borers when appear on foliage can be controlled by dusting Folidol (2%) @ 25-30 kg/ha. For the management of snails and slugs, weeds and other grasses near to crop fields should be removed because these are the hiding and breeding places for these pests. Pellets of Snail kill bait (metaldehyde 2.5%) can be broadcast or sprinkled in the field @ 37.5 to 62.5 kg/ha. For economy, a barrier of the poison bait can be made around the periphery of the fields. Best results are achieved when pellets are used in the field during a moist warm evening a few days after a dry spell.

It is essential to protect the crop against the attack of maize borer, a key pest of maize, otherwise heavy investment in the form of fertilizers and seed may be totally lost. The borer attack is noticeable soon after germination. When the plants are 10 days old, they should be sprayed with 750 ml Lindane (gamma HCH) 20 EC in 500 L water/ha. In order to avoid washing off of insecticides by rains, the granules of Thimet (phorate) 10G @ 2g/m row can be applied either in the soil before sowing or sprinkled over the central whorl especially of those plants showing shot holes (Kakar et al., 1980). In granular form, insecticides are more effective against the borer. Granular application also takes care of other insect-pests both in soil and on above ground plant parts. Since the pest hibernates in larval stage inside the stalks, cobs, stubbles, it should be killed by shelling the cobs and burning the cores and by chopping or burning the stalks. The stubbles should also be collected and burnt after ploughing up the fields. To compensate the plant mortality due to early borer attack, high seed rate can be used. Plants showing shot holes or borer injury can be uprooted and destroyed to prevent further spread of infestation.

Whenever attack of blister beetles reaches at economic injury level, endosulfan (0.07%) (1250 ml Thiodon/Endocel/Hildan 35 EC) or methyl parathion (0.05%) (625 ml Metacid 50 EC) or deltamethrin (0.0028%) (625 ml Decis 2.8 EC) or cypermethrin (0.0075%) (470 ml Ripcord 10 EC) in 625 litres of water per ha can be sprayed at tasseling stage (Anonymous, 1993).

Most of the non-arthropod pests like rats, jackals, porcupines, birds are managed
on community/village campaign basis. For controlling rats, close all burrows in the evening and fumigate the reopened burrows with Celphos (aluminium phosphide) using ½ part of 3g tablet per burrow in clay and sandy soils. Poison bait prepared with zinc phosphide can be used against rats. For this, smear 19.5 kg wheat, gram, maize or bajra grains with sarson oil and mix with it 500g zinc phosphide. Put one tablespoon of these poisoned grains in or outside the burrows.

Jackals and porcupines can be killed by shooting. Burrows of porcupines can be fumigated with Celphos/Phostoxin (aluminium phosphide) tablets. For the management of birds, they can be scared by mechanical bird scarers. Crows and sparrows can be killed by feeding them on chapatis or wheat grains soaked in 2% fenthion (Lebaycid 50 EC) (soaked in emulsion for 6 hours and then dried in shade) (Anonymous, 1993)

Pests of maize in storage

Preventive measures:(i) Moisture content in grains should not exceed 10 per cent.
(ii) Store the grains in clean godowns; fill cracks, crevices and holes with cement.
(iii) Use new gunny bags. Old bags if used must be disinfected by dipping in 1 part of Malathion/Cythion (malathion) 50 EC in 500 parts water for 10 minutes and dried in shade before filling the grains.

(iv) The grains can be best protected by using improved insect-proof receptacles of various types.

Curative measures:(i) Surface treatment: A thorough spraying of 0.5% malathion emulsion (0.5%) on exposed surface in godown is effective. Alternatively, DDVP @ 3 litres per 100 sq. metre surface area in the ratio of 1:300 of 100 EC can be used.
(ii) Seed treatment: Mix Malathion/Cythion (malathion) dust (5%) @ 250g/quintal seed or 2.5kg/metric tonne grains meant for seed only.
(iii) Fumigation: Hydrogen phosphide (Aluminium phosphide) can be used for fumigation @ 1 to 2 tablets per metric tonne or 25 tablets per 100 cubic metre of space with an exposure period of 7 days. Another suitable fumigant, which can be used under ordinary conditions of storage is the mixture of ethylene dichloride and carbon tetrachloride (EDCT mixture) @ 35 litres per 100 cubic metre space with four days of exposure. Ethylene dibromide (EDB) is used @ 10.5kg/100 cubic metre space with an exposure of 6 days for fumigation. The use of EDB ampoules @ 1 ampoule of 3 ml/quintal seed has been found suitable for fumigation of grains stored in small quantities in household structures that can be made reasonably airtight.

REFERENCES