

Biotic Stresses of Pulses in North Eastern Hill Region of India

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ABSTRACT

Biotic stresses in North Eastern Hills (NEH) region of India are limitations that mitigate production of pulses. Although farmers in NEH region still practise traditional farming practises (shifting cultivation in 2.7 m ha), yet biotic stresses are major constraints to achieve yield. The present paper aims to examine the problems of biotic stresses such as diseases, insect-pest and weeds prevailing in the region. The major diseases prevalent in the region are *Ascochyta* leaf blight; *Cercospora* leaf spot; Anthracnose in green gram; powdery mildew in peas; wilt and *Phytophthora* stem blight in pigeon pea, rust in rice bean, powdery mildew, leaf blight, urad bean leaf crinckle virus (ULCV) in black gram. Pod borer complex, cut worm, aphids, stem fly, flea beetle, blister beetle, pod boring weevil and Bihar hairy caterpillar emerge as important insect pests and well distributed throughout the region. Weeds assume great importance in managing biotic stresses in high rainfall area like NEH region. Pest surveillance, pest ecology, conservation of natural enemies in field, manipulation of agronomic practices, use of resistant/tolerant varieties and lesser use of pesticides are the major strategies for management of biotic stresses of pulses in NEH region.

The North Eastern Hills (NEH) region of India is endowed with rich natural resources of soil, water and vegetation. The region comprising the state of Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura lies between 21.5° N to 29.5° N latitude and 85.5° E to 97.5° E longitude. It has a total geographical area of 18.3 m ha and a population of 9.4 m people representing 6.0% and 1.03% of the total area and population of the country respectively. The region is almost bottled up between Bhutan and Tripura in north, Myanmar in east and Bangladesh in south (Fig.1). The region can be broadly divided into three physiographic zones: I) Hills and mountains of wide topography II) peninsular/folded plateau and III) plains. The region falls under high rainfall zone (1000-4000 mm) and the climate differs from subtropical to alpine. The region is characterised by difficult terrain, wide variation in slopes and altitudes and cultivation practices. The agricultural production system in the region is mostly rainfed, monocropped and at subsistence level. Slash and burn agriculture is still predominantly practised in almost all the states except Sikkim on steep slopes.

Some of the special characteristics of the mountain and hill ecosystem of the region are inaccessibility (a product of altitude and terrain), fragility (a product of steep slope and other biological conditions), marginality (a product of natural and man made factor), biodiversity,

multiple ethnicity and natural suitability or 'niche'. The entire NEH Region falls under Sub-Himalayan Zone II. On the basis of topography, agro-meteorological parameters, soil types, crop grown etc., the region has been divided into six agro-climatic zones viz. alpine, temperate sub alpine, subtropical plan, sub tropical hill, mild tropical hill and mild tropical plan.

PULSES IN NEH REGION

The cropping pattern in NEH region with exception of Sikkim, is characterised by predominance of rice as the food crop. In Sikkim, the dominant crop is maize. Food crops account for more than 80% of the gross cropped area of the region, which is suggestive of the subsistence agriculture and lack of crop diversification. About 70% of the gross cropped area is accounted by cereals alone. Judging from the percentage of distribution of area under different crops, the cropping pattern in the region, could, by and large, be said to be cereal based. Within the region, however there are exceptions like Nagaland and Tripura. These state level variation are a manifestation of the difference of the states of agricultural development particularly in the constituent units of the region. The major pulses grown in the region are: greengram [*Vigna radiata* (L) Wilczek], blackgram [*V. mungo* (L) Hepper], cowpea [*V. unguiculata* (L) Walp], bengal gram [*Cicer arietinum* (L)], pigeon pea [*Cajanus cajan* (L) Millsp] and rice bean [*V. umbellata* (Thumb) Ohwi & Ohashi]. Except bengal gram all other pulse crops are grown in Kharif. Bengal gram is a rainfed rabi crop. Field pea is also grown in rabi but more for vegetable than for pulse purpose. In hills, most of the local beans (rice bean, cow pea, adzuki bean, winged bean, sword bean, jack bean, dolichos bean etc.) are grown predominantly under rainfed conditions in a mixed farming system, under shifting cultivation or in kitchen gardens and back yards. There has been enormous diversity of the beans in NEH region (Sarma et al, 1991). The area, production and productivity of pulses in NEH region (1997-98) are shown in Table 1. It has been observed that the area under the pulses is only 50.3 thousand ha as against 22432.2 thousand ha of all India. Thus the share of NEH region in pulses is only 0.2% in area and 0.3% in production. However, the productivity is more in NEH region than national average. If we examine the causes of such negligible area and production of pulses in the region, we find that in addition to the non existence of economic rationality of the cropping pattern and socially optimum cropping pattern and also crop diversification, the biotic factors play a major role in limiting pulses production in the region. Among the biotic stresses, diseases, insects, pests and weeds create enormous problems in rainfed agriculture. This paper highlights the diseases, insects, pests and weeds in pulses under humid, hilly eco-systems of NEH region.

DISEASES

Plant diseases cause economic losses in the yield to a great extent. It was estimated that diseases caused 25% loss of crop yields as compared to 20% by insect pests (Verma and Verma, 1991). The region receives mean annual rainfall of more than 2000 mm and remain humid almost throughout the year. As a result there exists serious disease problems. Survey conducted in NEH region for a number of years revealed that leaf spot, powdery mildew in green gram and black gram, wilt and anthracnose in pigeon pea, leaf spot, anthracnose, rust, pod blight in french

bean, leaf spot in cow pea, powdery mildew, leaf blight in peas, rust, powdery mildew and *Cercospora* leaf spot in rice bean are major diseases. The diseases are collated in Table-2 and their distribution is depicted in Fig 1.

INSECTS PESTS

Insects pests are serious yield reducers of pulses in NEH region. As the climatic conditions favour very much the different types of agricultural crops including pulses, it also suits very much the multiplication of insects pests. Since insect problem pertains to bioenvironmental approach (Kushwaha and Shri Ram, 1994) therefore, insects pest problems in the region are many and serious. Survey conducted in the different states of the region varying from the foot hills to high altitude has revealed the insect pest association with pulse crop, their status incidence pattern as well as natural enemies. (Anon 1977-79).

Several species of the insects pest attack pigeon pea from germination to maturity. The most important insect pest of pigeon pea is pod boring weevil (*Apion clavipes*). The other pests of pigeon pea are pod borer (*Heliothis armigera* and *Etiella zinckenella*), pod fly (*Agromyza obtusa*), blister beetles (*Mylabris phalerata*, *M. pustulata*), Aphids (*Myzus persicae*) and flea beetles (*Chaetocnema basalis*). The pod boring weevil is a new record in pigeon pea and ricebean and is a serious pest in Meghalaya (Sarma et al, 1995). In Tripura termites (*Odontotermes sp.*) are serious pests in pigeonpea under upland conditions. In Manipur and Arunachal Pradesh pod borer and weevil are major pests of pigeonpea causing 10-15% damage to the pods. Pod boring weevil alone causes 77% damage to the pods and 43% damage to the pods. The insects pest of other pulses are collated in Table 3 and their distribution is depicted in Fig. 2.

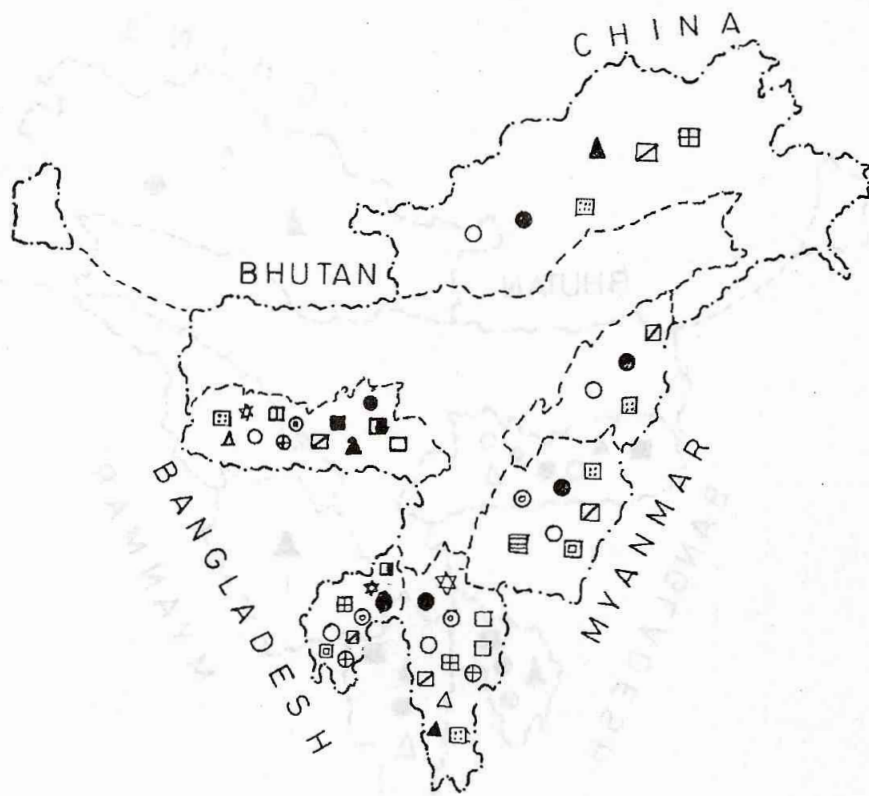
WEEDS

As a result of conducive weather conditions prolific growth of weeds causes serious problems in pulse crops of the region. The soil is also rich in unhumidified organic matters. Weed problem thus assumes an alarming proportion and is a major hinderance in crop production. The undulating land surface with large variation in slopes (0-100%), altitude and rainfall pattern lead to a diversification of weed flora. The high rainfall during April to September and sparse rainfall during winter is a major factor supporting the diverse weed flora. The weeds compete with pulse crops for the nutrients and harbour insect pests. Because of excessive rains during cropping season, it has become difficult to control weeds either manually or by spraying herbicides. The major weeds of the pulse crops in upland are enumerated below :

Grasses : *Eleusine indica*, *Digitaria marginata*, *Panicum psilopodium*, *Cynodon dactylon*, *Imperata cylindrica*, *Cyperus iria*

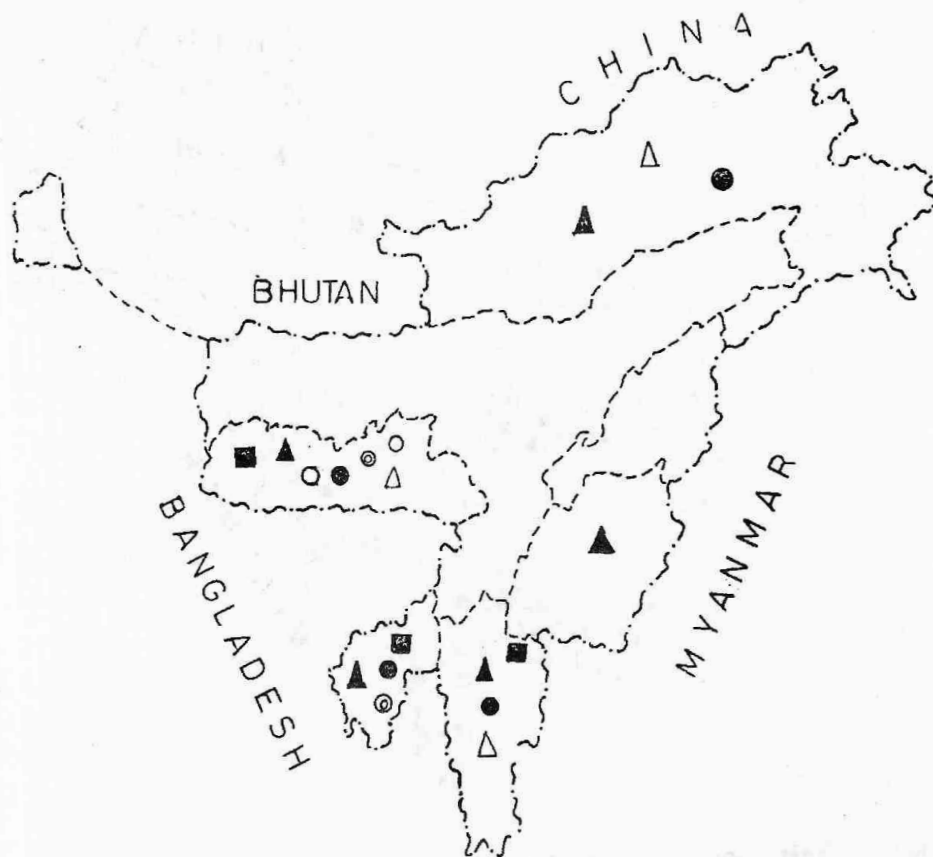
Broad leaf : *Biddens pilosa*, *Galinsoga parviflora*, *Ambrossia sp.*, *Ageratum conizoides*, *Eupatorium odoratum*, *Polygonum sp.*, *Boerhaavia hispida*, *Mimosa pudica*, *Amranthus viridi*.

The use of shorter duration, high yielding varieties of efficient pulse crops and cropping systems is one of the means of minimising the risks of biotic stresses. Use of genotypes resistant



<u>Blackgram & Greengram</u>	<u>Pigeon Pea</u>	<u>Cowpea</u>	<u>French bean</u>
○ Seedling blight & stem rot	⊞ Wilt	☆ Leaf spot	☆ Leaf spot
● Charcoal rot	⊕ Anthracnose	▢ Mosaic	▢ Mosaic
⊙ Ascochyta leaf spots	⊞ Anthracnose	▣ Rust	⊕ Anthracnose
□ Cercospora leaf spots	<u>Field pea</u>	<u>Lentil</u>	▣ Pod blight
⊞ Powdery mildew	⊞ Powdery mildew	⊞ Powdery mildew	
■ BLC V	▣ Rust	⊞ Wilt	
	▢ Leaf blight	▣ Rust	
	△ Downy mildew		
	▲ Foot rot & blight		

Fig. 1. Statewise distribution of diseases of pulses in N E Hills of India



Blackgram & Greengram

- Leaf folders
- Aphids
- ⊙ Bihar hairy caterpillar
- △ Blister beetle

Gram, Lentil, Rajmash & other beans

- ⊕ Cut worms
- Flea beetle
- ▲ Pod borer
- Aphids
- △ Blister beetle

Pigeon pea

- ▲ Pod borer
- △ Blister beetle
- ⊙ Bihar hairy caterpillar

Field pea

- ⊗ Semi looper
- Aphids
- ⊕ Cutworms
- ⊙ Bihar hairy caterpillar

Cowpea

- Aphids
- Pod boring weevil
- Flea beetle

Fig. 2. Statewise distribution of pests of pulses in N E Hills of India

to pests and diseases and integrated pest management is the best approach to minimise the risk but at the same time rational use of pesticides should not be ruled out. The economic and environmental considerations should be given due weightage. Destruction of crop residues, clean cultivation or field sanitation, use of healthy seeds, use of resistant varieties, proper water management practice of crop rotation and trap crop, thinning, time of planting and harvesting, hand picking of insects, integrated management of insects, diseases and weeds are some of the approaches to save pulse crop from different biotic stresses.

Table 1. Area production and productivity of total pulses in NEH region 1997-98

State	Area ('000ha)	Production ('000 t)	Productivity (Kg/ha)
Arunachal Pradesh	6.5	6.6	1015
Manipur*	4.1	1.6	390
Meghalaya	3.3	3.0	909
Mizoram	4.1	4.5	1098
Nagaland	16.4	12.6	768
Sikkim	6.7	5.9	880
Tripura	9.2	5.3	806
NEH Total	50.3	39.5	785

Pulses include greengram, blackgram, pigeonpea, gram, ricebean & other beans.

*1994-95 estimate source : Director of Economics and Statistics, Govt. of India, New Delhi.

Table 2. Disease, host, pathogen and distribution in NEH region

Disease	Host	Pathogen	Distribution
Seedling blight	greengram, blackgram, cowpea	<i>Corticium rolfsii</i>	Ap, Mn, My, Mz, NI, Sk, Tp
Charcoal rot	greengram, cowpea, blackgram, broadbean	<i>Macrophomina phaseolina</i>	Ap, Mn, Mz, My, NI, Sk, Tp
Ascochyta leaf spot	greengram, blackgram	<i>Ascochyta phaseolorum</i>	My, Mz, Tp
Cercospora leaf spot	greengram, blackgram, cowpea, wingedbean, dolichos bean, ricebean, frenchbean	<i>Cercospora canescens</i> , <i>C. dolchi</i> , <i>C. cruenta</i>	My, Mz, Sk, Mn

Disease	Host	Pathogen	Distribution
Powdery mildew	greengram, blackgram, peas, lentil, horsegram, ricebean	<i>Erysiphe polygoni</i> , <i>Oidium sp.</i>	Ap, Mn, My, Mz, NI Sk, Tp
Leaf crinkle virus	blackgram	<i>BLC virus</i>	My
Wilt	pigeonpea	<i>Fusarium udam</i> <i>var cajani</i>	My, Mz, Tp
Anthracnose	pigeonpea, horsegram	<i>Sclerotium rolfsii</i> <i>Collectotrichum lindemuthianum</i>	My, Sk
Mosaic	frenchbean, cowpea	<i>virus</i>	Mn, Tp, My, Mz
Anthracnose	frenchbean	<i>Collectotrichum lindemuthianum</i>	Ap, My, Mz, Sk, Tp
Pod blight	frenchbean	<i>Cercospora sp.</i>	My, Mz, Sk, Tp
Rust	frenchbean, ricebean, peas, lentil, broadbean	<i>Uromyces appendiculatus</i> , <i>U. fabae</i>	My, Mz, Sk, NI, Ap, Mn
Leaf blight	pea, blackgram	<i>Alternaria tenuissima</i> <i>Cercospora cassicola</i>	Mn, My, Sk
Downy mildew	pea	<i>Pernospora pisi</i>	My, Mz, Sk
Root rot	pea	<i>Aschochyta pisi</i>	Ap, My, Mz
Aerial blight	horsegram	<i>Rhizoctonia solani</i>	Sk
Root knot	blackgram, greengram, pea, ricebean	<i>Meloidogyne incognita</i>	Ap, Tp
Leaf spot	ricebean	<i>Pleospora sp.</i>	Mn
Circular leaf spot	pea	<i>Alternaria sp.</i>	My, Mn
Damping off	cowpea	<i>Sclerotium sp.</i>	Sk
Target spot	pea	<i>Corynospora sp.</i>	Sk
Leaf spot	pea	<i>Phyllosticta sp.</i>	My, Mz, Sk, Tp

Ap : Arunachal Pradesh, Mn : Manipur, My : Meghalaya Mz : Mizoram NI : Nagaland Sk : Sikkim Tp : Tripura

Table 3. Major insects pest of pulses in NEH region

Crop	Insect pest	Scientific name	Distribution
Pigeonpea	Pod boring weevil	<i>Apion clavipes</i>	My, Mn, Ap, NI
	Pod borer	<i>Heliothes orgmiger</i>	My, Mn, Ap, Mz, Tp
		<i>Etiella zickonella</i>	My, Mn
	Podfly	<i>Agromyza obtusa</i>	My
	Bhistea beetle	<i>Mylabrius phalerata</i>	My, Ap, Mz
		<i>M. pustulata</i>	
	Aphids	<i>Myzus persicae</i>	My, Mn
	Flea beetle	<i>Chaetocnema basalis</i>	My
	Termites	<i>Odnoterme sp.</i>	Tp
	Bihar hairy cater piller	<i>Dincriisia obligua</i>	My, Tp
	Leaf weber	<i>Anersin eppripping</i>	My
Cowpea	Aphids	<i>Aphis craccivora</i>	Ap, My, Sk, Tp
	Pod boring weevil	<i>Apion clavipes</i>	Ap, My, Sk, Tp
	Flea beetle	<i>Monolepta signata</i>	My, Sk
Pea	Semilosper	<i>Plusia michalcea</i>	Mn, Ap, Sk
	Aphids	<i>Acrythosiphon pisum</i>	Sk
	Cut worm	<i>Agrotis ispilon</i>	My, Mn
	Bihar hairy cater piller	<i>Dincriisia obligua</i>	My, Ap
	Leaf miner	<i>Phytomyza attricornis</i>	Mn
Beans	Cut worm	<i>Agrotis ispilon</i>	Sk
Lentil	Flea beetle	<i>Monolepta signata</i>	Mz
Gram	Pod borer	<i>Heliothis argmiger</i>	Ap, My, Mz
	Aphids	<i>Aphis gossipii</i>	Ap, My, Mz, Tp
	Blitter beetle	<i>Mylabris pustulate</i>	My, Mz, Tp
	Leaf roller	<i>Gracilloria soyella</i>	Mn, My
	Red mite	<i>Tetranchus cucurbitae</i>	Min
Blackgram	Leaf folder	<i>Nacolea vulgaris</i>	My
Greengram	Aphids	<i>Aphis cracivora</i>	My, Sk
	Bliter beetle	<i>Epicauta sp.</i>	My
	Bihar hairy cater piller	<i>Dincriisia obligua</i>	My
Ricebean	Pod boring weevil	<i>Apion clavipes</i>	My, Sk
	Aphids	<i>Aphis craccivora</i>	My
	Leaf roller	<i>Gracilloria sovella</i>	My
	Leaf folder	<i>Nacolea sp.</i>	My
	flea beetle	<i>Monolepta signata</i>	My, Mn, Ap

Ap : Arunachal Pradesh, Mn : Manipur, My : Meghalaya Mz : Mizoram NI : Nagaland Sk : Sikkim Tp : Tripura

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