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Studies on some diseases of fruits and vegetable crops in relation to meteorological parameters

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सार – महाराष्ट्र राज्य के पुणे और पाडेगाँव में टमाटर, अमरूद और अंजीर के कुछ रोगों के प्रभावों को नियंत्रित करने वाले विभिन्न मौसम विज्ञान के प्राचलों की भूमिका का अध्ययन आलेखीय अध्यारोपण और सहसंबंध तकनीकों द्वारा किया गया। पाडेगाँव में जनवरी माह में अंजीर पर कीटों के अधिकतम दुष्प्रभाव देखे गए जबकि पुणे में अमरूद पर फल के केंकर रोग के अधिकतम दुष्प्रभाव और टमाटर पर आरम्भिक सूक्ष्म कीट क्रमशः सितंबर से अक्तूबर के प्रथम सप्ताह ओर सितंबर से नवंबर माह में देखें गए हैं। तापमान में अधिकतम वृद्धि के कारण फल के केंकर रोग ओर आरम्भिक सूक्ष्म कीट दोनों के दुष्प्रभाव में वृद्धि देखी गई है। अपराह्न के समय सापेक्ष आर्द्रता में कमी फल के केंकर रोग के लिए और कीट के दुष्प्रभाव के लिए अनुकूल पाई गई है। न्यूनतम तापमान और तेज धूप के घटों में कभी भी क्रमशः फल के केंकर रोग ओर कीट के दुष्प्रभावों को बढ़ाती है।

ABSTRACT. The role of different meteorological parameters controlling the incidences of some diseases on tomato,guava and fig grown at Pune and Padegaon in Maharashtra state were studied by graphical superimposition and correlation techniques. Peak infestation of rust on fig was observed in January at Padegaon whereas maximum infestation of fruit canker on guava and early blight on tomato were reported respectively from September to first week of October and September to November at Pune. Increase in maximum temperature was found to increase the infestation of both fruit canker and early blight. Decrease in afternoon relative humidity favoured the infestation of fruit canker and rust. Fall of minimum temperature and rise in bright hours of sunshine also aggravated the incidences of fruit canker and rust respectively.

Key words – Fruit canker on guava, Rust on fig, Early blight on tomato, Meteorological parameters, Interrelation.

1. Introduction

Apart from disease management through direct interference with disease based on forecasting,there is also indirect interference possible, based on knowledge about interactions of pathogens and meterological conditions. Though severity and damage caused by several disease on palants are well known, not in all cases are timely prophylatic measures taken to minimise such damages. This is mostly for want of data on the precise environmental conditions favouring the disease onset and spread (Rangaswami 1975). Based on the knowledge of the interrelation of disease incidence and meteorological parameters, recommendation and advice can be given on management of these disease problem as far as these may be controlled in a certain regions of climate (Turkenstenn and Lablans 1987).

The climate and soil of Maharashtra provide scope for growing various horticultural crops such as fruits, vegetables, spices, condiments and flowers. These crops play a vital role in increasing the income, furnishing employment opportunities and also solve other chain of socioeconomic problems. The quality of horticultural produce, particularly pest and disease free for export as well as for inland consumption, is a basic requirement. Maharashtra formerly had more than 500 hectares of land where fig was cultivated. Largely because of diseases the figure has decreased to less than 125 hectares (Indian council of Agricultural Research

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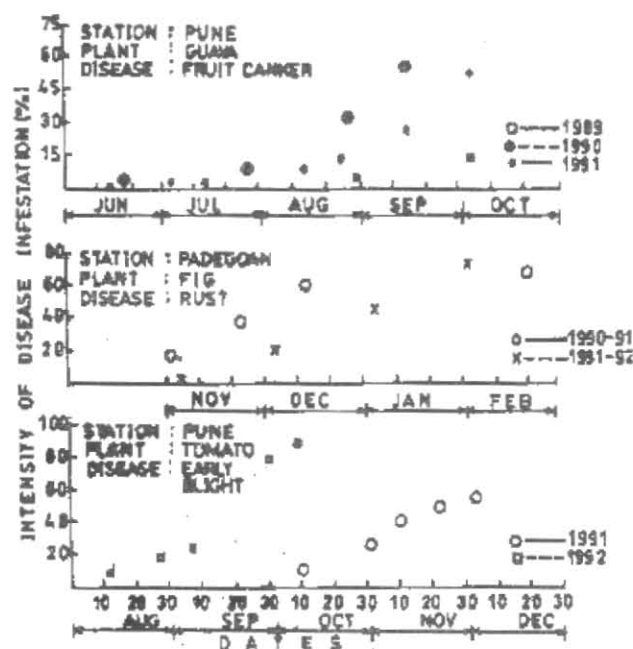*Present affiliation : Meteorological Centre, Lucknow

Fig. 1.   Intensity of infestation of difficult diseases on different dates in
some fruits and vegetable crops

1987). Though much literature is available on the effect of weather on the incidences of disease in cereals and oilseeds , the work done on vegetables and fruit crops particularly in Maharashtra is rather scant. In view of this, a study has been undertaken to determine the climatic parameters favourable for the incidences of some diseases on vegetable and fruit crops grown at Pune and Padegaon in Maharashtra state and thus possibly to highlight the alert days, for taking protective measures against diseases, at appropriate time, based on weather parameters.

2.   Data and methodology

The quantitative disease data presented herein pertains to (1) Rust (*Cerotelium fici*) on fig, (2) Fruit canker (*Pestalotia psidi*) on guava and (3) Early blight (*Alternaria solani*) on tomato. Entomoligical data on fruit tanker from 1989-90, and data on intensity on early blight from 1991-92 from the Botanical Garden, Pune (73°51′ E, 18°23′ N) has been used in the present study. Observation on rust were recorded at Central Sugarcane Research Station, Padegaon (74°10′ E,18°21′N) from 1990-92. The daily data   on   maximum   temperature (T_{max}), minimum temperature (T_{min}) , bright hours of

sunshine (SSH), rainfall (RFL), relative humidity at 0700 LMT (RH-1) and 1400 LMT (RH-2) were also recorded at the respective stations. In all the years under study the variations in several meteorological recorded parameters occurring before each disease infestation were critically analysed by graphical superimposition and correlation technique. Significant correlation at 5% level between the intensity of disease with the meteorological parameters were tested at per the statistical table (vi) presented by Fisher and Yates (1938). The plotted curves based on actual value of meteorological parameters were compared with normal meteorological parameters (IMD 1991) .

3.   Results and discussion

Variation in the intensity of fruit canker, rust and early blight affecting guava, fig and tomato respectively on different days , in different years is presented in Fig. 1. In all the years under study fruit canker infestation appeared in the month of June and reached maximum from September to the first week of October. Rust infestation started in November and peak infestation was observed in January . In 1991, infestation of early blight on tomato extended from August to
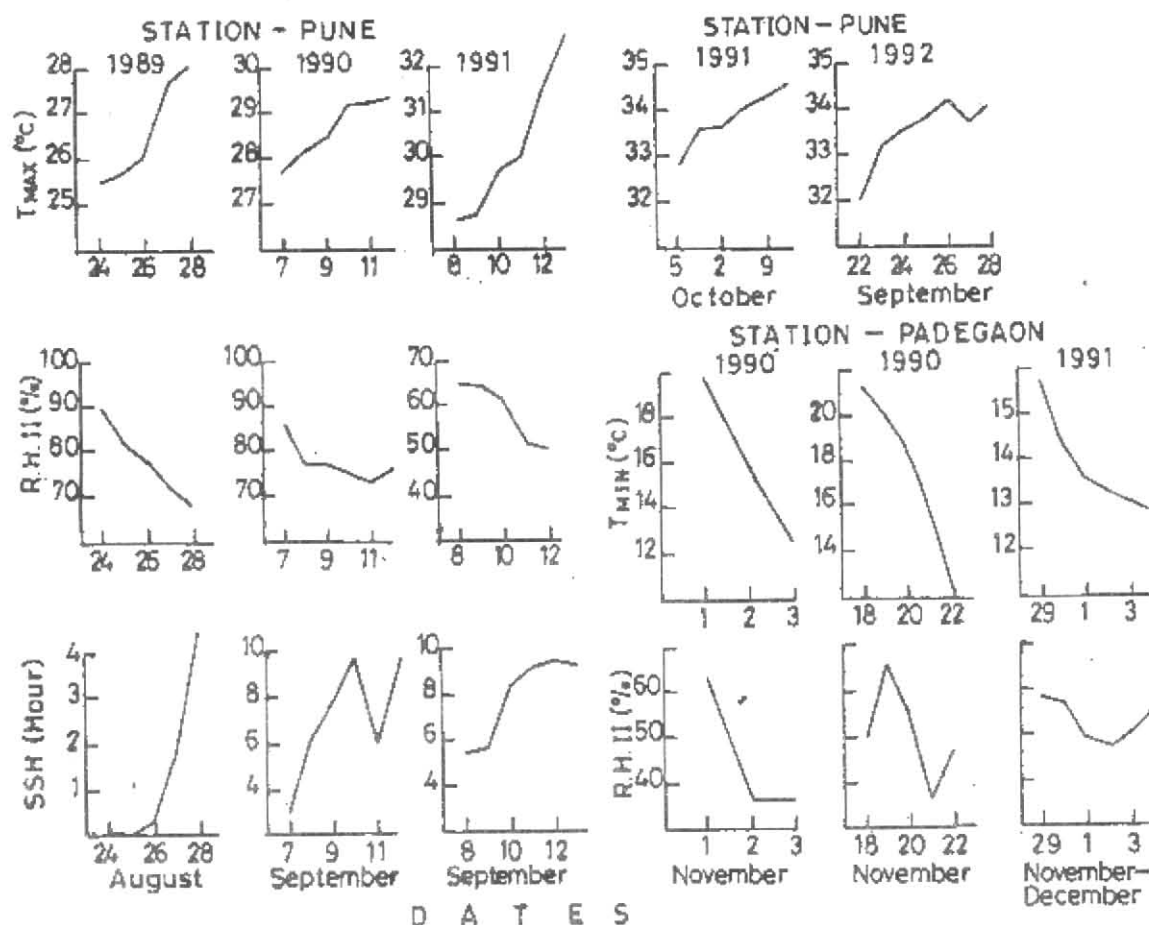
Fig. 2. Variation in meteorological parameters in different dates before infestation of diseases in fruits and vegetable crops

October whereas in 1992 its infestation period was from September to December.

It has been observed that once a disease appears on a certain crop, its intensity of infestation goes on increasing during couple of months if favourable weather conditions prevail. In order to indicate the effect of weather, the variations of different meteorological parameters during a few days before disease infestation for different crops, is presented in Fig. 2. The favourable climatic parameters influencing the different diseases are discussed below.

3.1. Fruit canker on guava

In all the years under study maximum temperature showed an increasing trend before infestation and its value rose by 1.5 to 3° C during 5 days before infestation. In all the cases at least one day before infestation, maximum

temperature lied above the normal T_{max} of the corresponding week. For instance, on 13th September 1991, the percentage of infestation of the disease was found to be 26.5°C. Though in this period a general increasing tendency of T_{max} was observed, maximum temperature increased from 28.6° C (8th September) to 31.5°C (12th September) which lied well above the normal value (28.6°C) of the corresponding week (37th standard week).

It has also been observed that before the infestation to occur, afternoon relative humidity (RH-2) showed, in general, a decreasing trend and fell by 13 to 22% within 5 days before infestation. In 1989, it was observed as decreased from 91% to 68% , from 23rd to 27th August. The infestation was observed on 29 August. Similarly, in 1990, it decreased from 86% to 73%, from 7th to 11th September, when the infestation was observed on 12th September. Preceded by small duration (0 to 5 hrs) of

TABLE 1

Correlation coefficient between daily meteorological parameters and infestation of different diseases

Disease	Meteorological Parameter	Days before appearance of disease				
		1	2	3	4	5
Fruit canker	SSH	0.33	0.51	0.63*	0.59*	0.54
	T_{max}	0.25	0.33	0.35	0.35	0.33
	RH-2	-0.34	-0.32	-0.30	-0.47	-0.44
Rust	T_{min}	-0.48	-0.39	-0.35	-0.35	-0.37
	RH-2	-0.32	-0.39	-0.25	-0.20	-0.17
Early Blight	T_{max}	0.95*	0.89*	0.87*	0.83*	0.80
	SSH	0.93*	0.89*	0.98*	0.92*	0.88*

* = Correlation significant at 5% level

sunshine hours, subsequent increased duration of SSH, in general, increased infestation. Significant positive correlation was observed between the intensity of infestation and sunshine hours three and four days before infestation (Table 1).Higher positive correlation ($r = 0.63$) was observed between SSH before three days and intensity and infestation. Thus, it appeared that cloudiness 5 days earlier to infestation activated the disease towards further development.

3.2. *Rust on fig*

Though a general falling tendency in minimum temperature was observed during the period of infestation of the disease in the years under study, minimum temperature was noticed to have dropped below 13° C before infestation and in all cases its value lied below normal T_{min} of the corresponding week. In 1990, intensity of infestation on 3rd November was 20%. T_{min} decreased from 19.7° to 12.4° C from 1st to 3rd November.

Like minimum temperature, afternoon relative humidity (RH-2) almost showed decreasing trend during a few days before the infestation. Just one day before the infestation its value was seen to have remained below 50%. It fell from 64% to 37% within one day *i.e.* from 1st November to 2nd November 1990 when 20% infestation was observed on 3rd November. Similar fluctuation of RH-2 was observed from 19th to 21st November in 1990

when it decreased from 76 to 46% . Intensity of infestation (37%) was observed on 22nd November.

3.3. *Early blight on tomato*

Among the various meteorological parameters maximum temperature was found to influence the early blight of tomato. During a few days before infestation, minimum temperature was increased and its value reached above 3° C of the normal T_{max} of corresponding week. In 1991, it was noticed to start increasing from 5th (32.8° C) to 9th October (34.3° C). The normal T_{max} of the corresponding week is 30.8° C. Infestation was observed on 10th October. Similar was the case for 1992 also.

Significant positive correlation was observed between minimum temperature one to four days before the infestation. Correlation coefficient values ranged from 0.80 to 0.95. This observed finding is in consonance with the work of Mundkur and Chattopadhyay (1967) . The authors stated that the disease become serious when the season began with abundant moisture followed by high temperature. According to Bajic, late blight of potato preferred rather warm condition for sporulation and produce spores during day under necessary humidity condition. Incidence of more disease infestation due to dry and warm condition were also reported in the Year Book of Agriculture (1953), ICAR (1987), Centre for Overseas Pest Research (1983) and also by Singh (1987). SSH was

also positively correlated with the early blight incidence from 1 to 5 days before infestation. Highest the correlation was observed between the duration of SSH 2 to 3 days before infestation and the intensity of infestation.

4. Conclusions

The main findings of this study are as follows :

(a) Peak infestation of rust on fig was observed in January at Padegaon whereas maximum infestation of fruit canker on guava and early blight on tomato were reported respectively from September to first week of October and September to November at Pune.

(b) For infestation of fruit canker on guava, both maximum temperature and afternoon relative humidity showed an increasing and decreasing trend respectively before infestation. T_{max} and RH-2 increased and decreased respectively by 1.5 to 3° C and 13 to 22% during 5 days before infestation. Proceded by low value before 5 days, the subsequent increased duration of sunshine hours increased infestation.

(c) For infestation of rust on fig, both minimum temperature and afternoon relative humidity showed a decreasing trend during few days before infestation. T_{min} and RH-2 fell below 13° C and 50% respectively just before the start of infestation.

(d) For infestation of early blight on tomato, among the various meteorological parameters only maximum temperature was found to influence the infestation of this disease. It showed an increasing trend and the value reached more than 3°C above the corresponding weekly normal before the infestation.

The plant protection for horticulture crops has been scheduled by the Plant Protection Wing of the Directorate of Horticulture (1992) with the help of the Committee of Scientists from all Agricultural Universities from Maharashtra State. The Plant Protection Recommendation for the diseases under this study are as follows:

Disease	Plant protection measures
Canker on guava	Spraying of Bordeaux mixture (0.25%) or Mancozeb 75 WP (0.25%)
Blight on tomato	Malathion 50 EC (0.05%) Endosulfan 35 EC (0.04%) Phosphamidon 85 WSC (0.02%)
Rust on fig	Phosphamidon 85 WSC(0.02%) Carbaryl 50 WP (0.1%) Dimethoate 30 EC (0.03%)

Based on the real time data of the meteorological parameters causing the incidence of the above diseases on different crops, above plant protection measure can be taken up in appropriate time to make crop free from such disease.

At the end, it can be mentioned that reliability of the result so far obtained in the present study may be increased if the actual quantitative data of the intensity of infestation recorded for a number of years are used. This is one among other limitations of studies such as the present one.

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