INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD ISSN: 2455-0620 Volume - 6, Issue - 7, July – 2020
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value: 86.87 Impact Factor: 6.719
Received Date: 07/07/2020 Acceptance Date: 25/07/2020 Publication Date: 31/07/2020

Variations in Phenological events of *Citrus limon* L. in two different regions of Gujarat

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Abstract: *The Phenological events of plant species includes seed germination, vegetative growth, flowering, fruit formation, fruit maturation, leaf fall, seed dispersal, and death. These phenological events can be recorded month wise, season wise and also region wise by diagramme which provide us valuable information. This type of diagram is known as Phenogram. Parameters on which the phenological observations were made are vegetative phase, flowering phase, leaf fall phase and budding phase. The aim of the present study is to compare the phenological patterns of citrus limon L. from different regions of Gujarat. Two regions were selected for this study (1) Saurashtra (study site: Vadhavi, Junagadh) and (2) Ahmedabad (Study site: M.G.science collage, Ahmedabad). Phenological pattern of citurs limon L. were observed at least thrice in month by visiting the selected study area. This phenological study revealed that the phenophases, vegetative phases and reproductive phases observed earlier in Saurashtra region than Ahmedabad region. This study concluded that there is remarkable variation in phenological events of Citrus limon L. in the different regions of Gujarat due to climatic and various environmental factors. And this phenological study gives us a complete guide line to understand the response of plant species to different climatic factors and the periodicity of the plant in the particular region and their environment. This type of phenological events of Citrus limon L. is firstly reported in the Saurashtra and Ahmedabad region with phenological variations.*

Key Words: *Citrus limon* L., *Phenology, vegetative and reproductive Phases, two different regions, Saurashtra and Ahmedabad*

1. INTRODUCTION:

The Phenological events of plant species includes seed germination, vegetative growth, flowering, fruit formation, fruit maturation, leaf fall, seed dispersal, and death. These phenological events can be recorded month wise, season wise and also region wise by diagramme which provide us valuable information. This type of diagram is known as Phenogram[1].Phenology is the relationship of the calender date and growth stages.These relationship provide us knowledge about outline of the plant growth and development as well as the effect of environment and their influences on flowering and fruiting behaviour[2].Abiotic environmental conditions such as rain, changes in temperature, competitors, presence/absence of pollinators and herbivores are play a significant role in timing of various phenological events.[3]A very important fruit crop *Citrus limon* L.is selected for this phenological study. Lemon is belongs to family Rutaceae which is originated in tropical and subtropical Southeast India[4]. There are many varieties of lime found all over the world, specifically in the tropical and the Mediterranean climates [5]. These varieties make the proper selection a significant tool in lemon breedings program. Lemon is a main source of vitamin C and There is also an increasing demand of "high quality fresh citrus" directed by World Health Organization recommendations.[6] Lemon grows on small, thorny trees and gain height up to 10 to 20 feet. The leaves are very dark inn color and arranged alternatively on the stem.Lemon has white and five petal fragrant flower. The color of lemon fruit is from greenish yellow to bright yellow.[7] So keeping in view the enormous scope of improvement and breeding of lemon, on the basis of phenological behaviour in different region, It is essential to take up the research work on the phenological aspect. The aim of the present study is to compare the phenological patterns of *Citrus limon* L. from different regions of Gujarat.

2. MATERIALS AND METHODS:

2.1. Study area:

The study of phenological events of *Citrus limon* L. was carried out in different regions of Gujarat during 2018.
Two regions were selected for this study
(1) Saurashtra (Study site: Vadhavi, District: Junagadh) and
(2) Ahmedabad (Study site: M.G. Science college, Ahmedabad).

From these study sites, trees of lemon and their branches were tagged for observations of various phenological events and visited these sites at least thrice in a month for observations. In Figure 1, a Phenogram with different phonological stages were shown. Where number 1 is indicate Vegetative bud formation; 2.Emergence of Inflorecence; 3.Leafing phase; 4.Flowering phase; 5.Fruit formation and fruit maturation; 6.Leaf fall phase and P-Perennation for phenological observations.

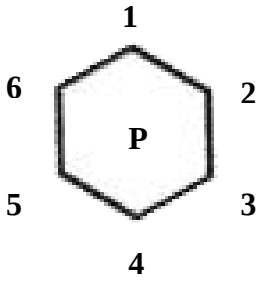

Figure 1: A Phenogram with Phenological events.

3. RESULTS:

The results of different phenological observations from vegetative bud formation to leaf fall are presented in Table 1 and figure 2 and their phenogram presented in Table 2.*Citrus limon* L. is very important fruit crop which is found throughout the year. From the present study, it is observed and recorded that vegetative bud formation is maximum at the end of May in Saurashtra region and during june in Ahmedabad region. The timing of vegetative growth in terms of flowering depends largly on the nature of the buds[8].Emergence of inflorescence of Lemon occurs in june in Saurashtra region while july in Ahmedabad region. This change occurs due to the variation in soil, their nutition and climatic conditions of different regions. Leafing are full bloom in the case of Saurashtra region seen maximum from June to September but in the case of Ahmedabad region, leafing was observed maximum during july to august. These variation may be occur due to the various ecophysiological factors of that regions. Flowering of lemon were occur maximum from june to august in saurashtra region while august to september in ahmedabad region. Fruiting duration is related to flowering time but fruit type is independent of flowering time. The fruit formation of *Citrus limon* L. is found maximum from July to september in saurashtra while in Ahmedabad it is found maximum in starting of September to october. This may be due to the variations in rainy seasons of these two different regions.

The fruit maturation of lemon takes place from the end of july to october in saurashtra but for ahmedabad, it was occurred from september to november. The leaf fall period of lemon tree occur during october to november in saurashtra while November to december in ahmedabad. It may be due to completion of their life cycle in required time of that particular region and their environment. Natural selection has also play a vital role to shape up phenological events of that fruit crop [9].

Figure 2 : Phenological events of *Citrus limon* L.

Table 1 : Phenological observations of *Citrus limon* L. from different regions of Gujarat.

Phenophases		Phases	Regions of Gujarat	
			Saurashtra	Ahmedabad
Vegetative phases	1	Vegetative Bud formation	End of May	June
	2	Emergence of inflorescence	June	July
	3	Leafing	June-Sept	July-Aug
Reproductive phases	4	Flowering	June-Aug	Aug-Sept
	5	Fruit formation	July- Sept	Sept-Oct
		Fruit maturation	End of July-Sept	Sept-Nov
Post-reproductive phase	6	Leaf fall	Oct-Nov	Nov-Dec

Table 2 : Phenogram of *Citrus limon* L. of different regions of Gujarat.

Study area	May	June	July	August	Sept	Oct	Nov	Dec
Saurashtra								
Ahmedabad								

4. CONCLUSIONS:

This phenological study revealed that the phenophases, vegetative phases and reproductive phases observed earliar in Saurashtra region than the Ahmedabad region which shows a strong regional variations in phenological events of *Citrus limon* L.in the different regions of Gujarat. The variations of different phenophases are due to the fluctuation of environmental condition, habitat and availability of the soil, their nutrient which was adapt to the habitats accordingly with the surrounding abiotic and biotic environment of this study area of selected different regions. The climate variables such as wind, rain, air, humidity, temperature and light intensity were also found to be important factors controlling the time and duration of these phenological events in this fruit crop [10]. Phenological studies are also necessary to understand species interrelations and their interaction with the environment of that region. Variations in the phenophases among the individuals of plant species or different species have been associated with their environmental disturbance [11]. From this study we can say that there is significant variation between phenological events of *Citrus limon* L. in different region of Gujarat due to the climatological and ecological factors. This type of phenological events of *Citrus limon* L. is firstly reported in the Saurashtra and Ahmedabad region with phenological variations.

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