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CHANGEABILITY OF THE VEGETATION PERIOD DURATION AND ITS COMPONENT PARTS IN THE COLLECTION SAMPLES OF *CAPSICUM ANNUM L. CONVAR. LONGUM DC*

Kormosh S.M. – Candidate of Agricultural Sciences,
Senior Research Officer, Head at the Laboratory of Vegetable
and Spicy-Aromatic Cultures, Zakarpatian State Agricultural Experimental Station
of National Academy of Agrarian Sciences

*The article shows the results of the study of genetic peculiarities of the collection samples of *Capsicum annum L. convar. longum DC* according to the duration of the vegetation period in general and of the separate stages of the plant's development. The influence of the inter phase periods and ecologic factors on the vegetation in general had been established and the difference in the genetic organization of this characteristics had been shown as well. The ways of using them in the selection process were being marked.*

Key words: pepper, paprika type, vegetation period, phases of development, duration, correlation, clusters, samples.

Кормош С.М. *Мінливість тривалості вегетаційного періоду і його складових колекційних зразків *Capsicum annum L. convar. longum DC**

*У статті висвітлено результати з вивчення генетичних особливостей колекційних зразків *Capsicum annum L. convar. longum DC* за тривалістю вегетаційного періоду в цілому та окремих фаз розвитку рослин. Встановлено вплив міжфазних періодів і екологічних факторів на проходження вегетації в цілому і показано відмінності в генетичній організації цієї ознаки. Намічені шляхи використання їх у селекційному процесі.*

Ключові слова: перець, тип паприки, вегетаційний період, фази розвитку, тривалість, кореляція, кластери, зразки.

Кормиш С.М. Изменчивость продолжительности вегетационного периода и его компонентов коллекционных образцов *Capsicum annuum L. convar. longum DC*

*В статье приведены результаты изучения генетических особенностей коллекционных образцов *Capsicum annuum L. convar. longum DC* по продолжительности вегетационного периода в целом и прохождения отдельных фаз их развития. Показано влияние экологических факторов на развитие растений и отличия в генетической организации этого признака. Намечены пути использования этих данных в селекционной работе.*

Ключевые слова: *перец, тип наприки, вегетационный период, фазы развития, продолжительность, корреляция, кластеры, образцы.*

Problem statement. Sweet pepper of paprika type is being used both in food industry and in the pharmaceuticals. In the today's market conditions the demands for the modern types of this sort are rather high for both – the vegetable goods producers and the processing enterprises. In this connection, there is a necessity of creation of the ecologically flexible sorts, which would form the high productivity, milled powder output and content of the useful matter. However, the maximum quantity of the valuable substances in sweet pepper of paprika type is being accumulated under the biological ripening of the fetus [1, p. 25; 2, p. 6,7; 3, p. 134–137; 4, p. 5–7]. Thus, for obtaining the bigger crop, it is being collected in the period of technical ripening and kept under the sun rays (thanks to which the accumulation of the useful matter continues), as when left on the plant, such peppers slow down the process of forming and ripening of the next peppers. That's why the creation of the competitive sorts with the high adaptive value to the growing conditions can be reached by using the scientifically-grounded approaches to the output formation, the use of which in the selection process would contribute to the balanced combination of these peculiarities with high processibility.

The plant is characterized by the ability to adapt to the limited factors of the growing conditions, which defines the adaptive qualities or flexibility of plants. The results obtained when studying the norms of plant's reaction on the agro ecological conditions, deep analysis of the genetic type and phenotype, productivity of plants in the given ecological conditions can serve the bases when elaborating the methodology of assessment of genetic fund of this culture for adaptive ability.

One of the main plant's characteristics which define the adaptive ability is the vegetation period and its duration, which considerably depend not only on the genetic potential of the sort, but also on the ecological factors of growing. That's why the important direction in selection with the sweet pepper of paprika type, is the creation of the forms, which have a relatively early ripening stage [5, p. 3–10]. The duration of the vegetation period, being the time necessary for passing through all the stages of the plant's development – is an important feature that defines the culture's adaptive ability to the conditions of its growing. [6, p. 102; 7, p. 272]. Solving the issue of the control of duration of the vegetation period will help not only in the creation of the sorts with the early fetus formation, and will contribute to defying the new and effective approaches of selection on drought hardness, pest resistance, and also the increase of productivity and quality of the vegetables. [8, c. 863–892].

Setting of a task. The duration of the vegetation period is one of the main characteristics for the practical selection according to the adaptive ability. It is extremely valuable for the assessment of the bio ecological peculiarities of the culture, which define the adaptive ability of the culture to the region of its growing. The changes of

ecological factors of environment, which occur nowadays, essentially influence the passing through the stages of the sweet pepper of paprika type development

Depending on the various climate conditions, the samples can transfer from one gradation of ripening to the other. That's why one of the main tasks for the selectors' practice is the creation of the sorts that would be able to form during the short period the biologically valuable crop. However, the sort is fast ripening not only when it has a short duration of the vegetation period, but when it is prone to the early development on all the stages of ontogenesis. That's why the assessment of the collection material according to the duration of the period of development in general and of the separate phases and analysis of the genetic organization according to the concrete characteristics will contribute to the allocation of the valuable samples according to the fast ripening for involving them into the following stages of the selection process. The questions which are touched upon in the article are important both for Ukraine in general, and for Transcarpathian region in particular, as this region is one of the perspective ones for growing the sweet pepper of paprika type.

Presentation of the main material of the study. The investigations were realized in the conditions of the open soil on the fields of Zakarpatian State Agricultural Experimental Station of NAAS during 2011–2016. The materials for investigations were 18 collection samples of sweet pepper of paprika type. The results obtained were compared with the conditionally accepted standards – Baktyanets (Ukraine) and Kolochai – 622 (Hungary).

Having analyzed the collection samples of paprika pepper type according to the duration of vegetation period from the sprouting to the ripen fetus we have divided them into five groups: E (early) – up to 120 days, ME (medium-early) – 121–130 days; M (medium) – 131–140days; ML (Medium-late) – 141–150 days; LR (late-ripen) – more than 150 days. Collection samples belong mostly to three groups – medium-early (38,9%), medium ripen (38,8%) and medium-late (22,2%) (table 1).

Table 1

Division of collection samples of sweet pepper of paprika type in the conditions of lowland zone of Transcarpathia, in average during 2011–2016

Ripening, days	Sample
Medium-early 121–130	
121–125	Baktyanets, K-1*
126–130	Beregivskiy big, K-1, BO-3, Д-1, K-401
Medium ripen 131–140	
131–135	Baranyachy rih, Isabella, Kolochai -622, Senteshi, B-8
136–140	Bene, D-206
Medium-late 141–150	
141–145	B-5, R-8, K-3
146–150	Festival

Among the medium-early most of the samples are of Ukrainian origin, those from Hungary are the medium ripen ones.

The division of the samples according to the results of the separate years differed from the average many years' data. To the best showing of the early ripening of the

collection material had contributed the conditions of vegetation of the following years 2012, 2015 and 2016. During these years, the vegetation period was in average the shortest and lasted for 119, 116 i 114 days. The longest vegetation period was in 2014 (tab. 2). The difference of vegetation period duration between the samples of sweet pepper of paprika type, depending from the years of investigation, made up from 1 (2016) to 14 days (2013). Such fluctuations between the duration of collection material vegetation, to our mind, were conditioned by the ecological factors of environment. We should mention, that the obtained data during the six years in general, had shown the weak changeability of this characteristics in the whole (coefficient of variation didn't exceed 10 %).

Table 2

Indicators of changeability of vegetation period duration “sprouting – biological ripening of the fetus”, samples of sweet pepper of paprika type

Year of study	X _{min} , days	X _{max} , days	X±s _x , days	V±s _v , %
2011	137	144	140±0,78	8,68±0,40
2012	114	124	119±0,91	9,19±0,38
2013	132	146	137±0,87	9,02±0,41
2014	142	147	146±0,67	8,59±0,43
2015	115	118	116±0,70	9,55±0,37
2016	114	115	114±0,65	9,98±0,42

Analysis of growth and development of the paprika pepper plant had shown that a very important is not only the general duration of the vegetation period, but the time of passing through the separate phases. There had been established, that the two different samples which in the same conditions of growing had the same duration of vegetation, differ in origin of the separate inter stage periods. That's why taking into consideration all these, we were studying the collection samples both according to the general duration, and the duration of the separately taken periods between the phases of sprouting, blossoming, technical and biological ripening.

The indicators of duration of inter phase periods in the sweet pepper of paprika type differ essentially in dynamics and depend on the sort peculiarities and agro climatic conditions of growing (tab. 3).

Table 3

Duration of the inter phase periods of the samples of collection of paprika type sweet pepper (2011–2016)

Year of study	Inter phase periods, days					
	Sprouting-blossom		Blooming-fetus ripening		Technical-biological fetus ripening	
	middle	min-max	middle	min-max	middle	min-max
2011	83	66–87	15	9–17	43	24–47
2012	78	64–85	10	7–14	31	16–32
2013	80	60–83	19	11–24	38	24–45
2014	87	58–89	19	14–21	40	25–47
2015	75	59–78	17	10–19	24	12–28
2016	74	53–74	17	14–21	22	13–26

The shortest vegetation periods were in 2012, 2015 and 2016, which conditioned the larger demonstration of the early ripening of pepper fetus. The investigations showed, that in general, the most changeable was the period of sprouting-blossoming, the response amplitude between the samples made up in 2011, 2012 and 2016, 21 days, in 2013–23, in 2014–31, in 2015–19 days. The fluctuation of the blossoming period-technical ripening of the fetus correspondingly 7 days (2012, 2014, 2016), 8 (2011), 13 (2013), 9 (2015) days and the period of technical-biological ripening fluctuated: 2011, 2013 and 2014 within the measures 21–23 days, in 2012, 2015–16 days and in 2016 correspondingly 13 days.

Basing on the results obtained after our researches, we have established that the general duration of vegetation period of the collection samples of paprika pepper type essentially depends on the passing through the period “technical – biological fetus ripening”. Correlation coefficient (r) in this case fluctuates within the measures from 0,64 to 0,74 and was the highest, the less influence had the period “ sprouting-blossoming”, ($r = 0,58-0,64$) (table 4)

Table 4

**Correlation (r) between vegetation period duration
in the whole and of its component parts**

Year of study	Inter phase periods, days		
	sprouting-blossoming	blossoming-technical fetus ripening	technical-biological fetus ripening
2011	0,63	0,36	0,64
2012	0,61	0,39	0,67
2013	0,62	0,37	0,70
2014	0,64	0,40	0,69
2015	0,60	0,34	0,72
2016	0,58	0,35	0,74

The least influence on passing through the vegetation period in general has the period of “blossoming-technical ripening” ($r = 0,34-0,40$).

Thus, formation of the vegetative and generative organs of pepper and intensity of the processes of the seed’s ripening essentially influences the duration of the vegetation period in general. Forming and term of fetus maturity depends not only from the inherited characteristics, but from the conditions of growing as well. The phases “sprouting – blossoming” and “technical-biological fetus ripening”, in the conditions of lowland zone of Transcarpathia falls on periods during which occur the biggest fluctuations of the limited factors – temperature and moistness, which define their duration.

By analyzing the correlation between the changeability of vegetation period according to the years of growing in general and their component parts as well, we have notices the essential diversity of demonstration. In different genetic types this correlation fluctuated with a considerable deviation, both to the positive and negative side. These differences show the various genetic organizations in the samples, of such a complex feature as the duration of vegetation period.

The selection work practice shows, that in the majority of samples even under the different ecological-geographical origin the genetic control of the separate characteristics is almost identical. The concrete feature in different samples is being controlled by

the genes of the same alleles. From this comes the limitation in receiving the new forms with the better demonstration of this feature. If the characteristics, according to which the selection is made, is defined and is controlled by the genes of different alleles, then in rising generation we can even expect the appearance of the forms with the new level of demonstration of this characteristics, which will contribute to the more precise choice of parental couples for obtaining the high index number of demonstration under this criterion.

Cluster analysis of the collection samples has showed that the most remote appeared to be the first and the fourth, which differed greatly according to the level of correlation between the duration of the separate phases and vegetation period in general. We should mention, that the samples of the remote clusters can be perspective ones in the selection process according to the chosen characteristics.

Conclusions. Approaches to the assessment of collection material had been proposed and the results of investigations of the sweet pepper of paprika type that had been obtained and give the possibility to make the division of the collection samples according to the genetic organization of these characteristics. This will contribute to the better choice of the parental couples for selection according to the chosen characteristics.

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