

Mechanical Rigidity and Lignine Content in Different Developmental Phases of Winter Rape Siliqua

V. KRATOCHVÍL

Oil-plant Breeding Institute, Opava *

Received January 4, 1968

Abstract. The lignine content and mechanical rigidity of siliquae of *Brassica napus* L. ssp. *oleifera* f. *biennis*, cv. Třebíčská were studied. Experimental plants were harvested in five consecutive periods and developmental stages of siliquae were determined on the basis of the weight of 1000 seeds. During the development of siliquae a gradual accumulation of lignine takes place; the content reached its maximum in certain developmental phases and then decreased. The mechanical rigidity of siliquae had a similar tendency. There were statistically significant differences in both properties studied within individual developmental phases. A highly significant positive correlation was found between lignine content and mechanical consistency.

Mechanical rigidity of siliquae of winter rape is an economically important property which leads to the decrease of liability for shedding of seeds during cultivation as well as during harvesting of this culture. From the point of view of plant breeding resistance for shedding) of rape was studied, starting from 1920, by LEMBKE (1959) who worked on breeding improvement of this plant by subjective methods, as reported by NICOLEISEN (1943). According to ANDERSSON, OLSSON (1960) the selection for increase of resistance for shedding) in rape was performed in Quedlinburg (BECKER), in Swalöf and by FIEDIUSZKO (1953) in Poland This problem is reviewed in more detail by LÖÖF (1958, 1961) who also described the method for evaluation of resistance for shedding in field conditions. Methods of laboratory analysis were worked out by JAKUBIEC, GROCHOWSKI (1963) and KRATOCHVÍL (1965).

The causes of resistance for shedding with regard to morphological and anatomical structure of siliquae were studied by NICOLAISEN (1943), LÖÖF (1961), GARLICKA (1961), KRATOCHVÍL (1962) and TOMASZEWSKA (1964). The relationship between the mechanical rigidity of siliqua and its phases of development, which was never studied before, is the subject of this communication.

* Address: Purkyňova 10, Opava, Czechoslovakia.

Materials and Methods

In our experiments we used *Brassica napus* L. ssp. *oleifera* f. *biennis* cv. Třebíčská. The field experiment was found and treated by ordinary agrotechnics, reviewed by VOŠKERUŠA and others (1965). The material was harvested at five intervals (Tab. 1). In each period 50 plants were harvested and kept in the drying room till they were submitted to laboratory analysis. Four siliquae were collected from each individual plant. From this set 80 siliquae were collected at random (in each interval studied) and their mechanical rigidity was determined according to KRATOCHVÍL (1965). The remaining siliquae, with their stalks reduced uniformly to three millimeters, were made free of seeds and analysed for the quantity of lignine according to FISCHER (1961). Analyses were repeated twice. The results were evaluated by analysis of variance and the minimum significant differences for $P = 95\%$ as well as highly significant differences for $P = 99\%$ were determined (see d-P in Tab. 2). In each collection the weight of 1000 seeds was determined.

Results

The development of siliquae in individual collections is characterized by absolute seed weight. Tab. 1.

From the F-values in Tab. 3 it is evident that there is a highly significant influence of individual collections on the quantity of lignine as well as on

Table 1

Data concerning individual collections and weight of 1000 seeds

Collection	Date	Weight of 1000 seeds in g
1	15. 6. 1962	0.53
2	21. 6. 1962	0.85
3	2. 7. 1962	2.13
4	7. 7. 1962	2.84
5	19. 7. 1962	3.68

the mechanical rigidity of siliquae in basal and apical regions. The influence of replication is not significant. As seen from Tab. 2, a gradual accumulation of lignine takes place during the development of siliquae (see collections). After reaching a maximum value in the time of full harvest, the lignine content decreases very slightly. The same tendency is observed for mechanical rigidity of the siliqua in the basal and apical region. There are significant differences between individual collections in the properties ob-

Table 2

Mechanical rigidity of siliquae and quantity of lignine in individual collections

Collection	$\bar{x}_1$	$\bar{x}_2$	$\bar{x}_3$
1	59.—	40.—	24.—
2	72.—	65.—	44.—
3	103.—	99.—	68.—
4	107.—	82.—	57.—
5	97.—	75.—	50.—

d-P 95% 1.3 9.— 6.9

d-P 99% 2.1 12.— 9.—

Explanations: $\bar{x}_1$ = milligrams of lignine per 1 g of dry weight $\bar{x}_2$ = rigidity of siliquae in the basal region $\bar{x}_3$ = rigidity of siliquae in the apical region

served. Correlation coefficients between lignine content and mechanical rigidity in the basal region ($r = 0.9$) and apical region ($r = 0.88$) show that there is a highly significant correlation between these two phenomena ($P_{0.05} = 0.63$, $P_{0.01} = 0.76$).

Table 3

Calculated and tabular F-values

Characteristic*	Calculated F		Tabulated F	
	collections	replications	collections	replications
$\bar{x}_1$	4051.22	0.45	16.—	21.20
$\bar{x}_2$	45.89	0.79	3.4	1.4
$\bar{x}_3$	59.03	0.91	3.4	1.4

* Indication the same as in Table 2.

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V. KRATOCHVÍL, Výzkumná stanice olejnin Opava: Mechanická pevnost a obsah ligninu v různých vývojových fázích šesuli. — Biol. Plant. 10 : 445—448, 1968.

Byl sledován obsah ligninu a mechanická pevnost šesulí u *Brassica napus* L. ssp. *oleifera* f. *biennis*, odrůda Třebíčská. Rostliny z kterých byly šesule odebírány byly sklizeny v pěti postupných termínech a vývojová fáze šesulí byla charakterizována vahou 1000 zrn. Během vývoje šesulí dochází k postupnému hromadění ligninu, jehož obsah dosahuje v určité vývojové fázi šesule svého maxima a potom opět nepatrně klesá. Obdobnou tendenci jako obsah ligninu vykazuje i mechanická pevnost šesulí. Mezi jednotlivými vývojovými fázemi šesulí byly zjištěny statisticky průkazné rozdíly v obou sledovaných charakteristikách. Mezi obsahem ligninu a mechanickou pevností šesule byla zjištěna vysoce průkazná kladná korelace.

В. Кратохвил, Исследовательская станция масличных культур, Опава: Механическая прочность и содержание лигнина в разных фазах развития стручка озимого рапса. — Biol. Plant. 10 : 445—448, 1968.

Исследовалось содержание лигнина и механическая прочность стручков у *Brassica napus* L. ssp. *oleifera*, f. *biennis* сорт Тшебичска. Растения убирали в пяти разных сроках и фазы развития стручков характеризовали весом 1000 зерен. В течении развития стручков лигнин постепенно накапливается, на определенной фазе достигает максимума и позднее его содержание незначительно снижается. Ту же тенденцию имеет и механическая прочность стручков. Различия по обоим характеристикам в разных фазах развития были статистически достоверными. Между содержанием лигнина и механической прочностью стручков установлена высоко достоверная положительная корреляция.