4. It has been established that the total lipids of the muscular tissue of the pelyad are characterized by higher contents of unsaturated acids than the neutral lipids.

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DYNAMICS OF THE ACCUMULATION OF THE FLAVAN COMPOUNDS OF *Hibiscus cannabinus*

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The amounts and compositions of the flavan compounds in various organs of kenaf according to the vegetation periods have been studied. It has been established that the maximum amounts of flavan substances are formed in the phloem and roots in the vegetation period.

Continuing an investigation of the phenolic compounds of kenaf [1], we have studied the amount and composition of the flavan substances according to vegetation periods in order to ascertain the dependence of the accumulation of flavanoids on such factors of the environment as the temperature and humidity of the air and the soil, and also their distribution over the organs of the plant. The plants were collected in 1979 and 1980 in the fields of the Politotdel collective farm in the Tashkent province in the following phases of development: shoots, incipient vegetation, budding, incipient flowering, mass flowering, and harvesting of the green kenaf. Because of a difference of weather conditions of 1979 and 1980, the dates of the vegetation periods differed correspondingly. The phenolic compounds were isolated from the raw plant material by extraction with aqueous methanol using the method of room-temperature steeping. To determine the total phenolic compounds their property of forming colored complexes with vanillin was used [2]. The intensity of the coloration was measured in a photoelectric colorimeter. The combined material was separated by PC in system 1. The separated zones were cut out and eluted and the amounts of material in them were determined by a method described in the literature [3]. Calculation was performed by means of a calibration curve plotted for the catechin complex of kenaf. The results on the amounts of flavans are given in Table 1.

Analysis of the results on the change in the phenolic compounds during the vegetation period shows that an intensive biosynthesis of phenolic substances takes place during the flowering phase. At this time, poly- and monoflavones, and also other intermediate phenolic compounds giving a coloration with the vanillin reagent, are formed.

*Deceased.

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TABLE 1. Amounts of Flavan Compounds in Various Organs of *Hibiscus cannabinus* according to Vegetation Periods

Vegetation period	Date	Flavans, % of the absolutely dry weight of the plant					
		leaves	phloem	bark of the roots			
				total	polymers	monomers	other phenols
	1979						
Shoots	May 23	Give a positive reaction with vanillin					
Incipient vegetation	June 15	None	0,35	3,0	2,5	0,5	—
Budding	June 28	"	0,80	8,0	5,5	1,8	0.7
Flowering	July 20	"	1,50	10,8	7,1	2,5	1.2
Mass flowering	July 30	"	0,8	10,5	7,0	2,0	1,5
Harvest	Sept. 1	"	0,2	10,0	7,7	2,0	0,3
Shoots	1980 May 15	Give a positive reaction with vanillin					
Vegetation	June 3	"	0,00	3,2	1,9	1,0	0,3
Budding	June 16	"	1,00	7,2	3,8	2,2	1,2
Flowering	July 2	"	1,90	11,4	6,5	3,5	1.4
Mass flowering	July 18	"	1,60	11,2	7,0	2,3	1,9
Harvest	Aug. 26	"	0,80	10,5	8,0	2,0	0,5

In the leaves, possibly under the action of sunlight, the process of biosynthesis takes place more intensively and in them we detected the most oxidized forms of the flavanoids — flavonols [4].

To determine the qualitative composition of the flavan compounds, the extracts were analyzed by partition PC [5] using the method of intensifying the spots in systems 1 and 2. For comparison, we used authentic samples of marker substances that we have isolated from tea and the cotton plant by a known procedure [6].

(−)-Epicatechin was identified in the leaves, phloem, and roots in the initial period of development of the plant (May 23, 1979; May 15, 1980). In the subsequent period no catechins were found in the leaves, but (−)-epicatechin and traces of other catechins which we were unable to identify were detected in the phloem in all periods. The most interesting material proved to be the roots of the plant. In the budding phase, (+)-catechin, (−)-epigallocatechin gallate, and (−)-epicatechin were identified in them. In the subsequent periods, in addition to those mentioned above, (−)-epicatechin gallate and two isomeric proanthocyanidins were found.

As can be seen from Table 1, the quantitatively predominating components of the roots and phloem of kenaf are the polymeric flavans, which we have assigned to the tannins of the condensed series. The qualitative composition of the tannin was determined by analyzing the products of its acid hydrolysis. From the hydrolysate we isolated catechins which were identified on the basis of their melting points, IR spectra, angles of rotation, elementary analyses, and PC in systems 1 and 2 as (−)-epicatechin gallate, (+)-catechin, (−)-epigallocatechin gallate, and (−)-epicatechin.

Thus, it has been established that catechins are formed in the phloem and roots of kenaf throughout its growth, but their maximum amount is found in the flowering phase, after which it decreases somewhat and by the period of harvesting it has become almost constant.

EXPERIMENTAL

The raw material fixed with boiling ethanol (1 : 5) and dried in vacuum was analyzed. The following weights of raw material were taken for extraction: leaves, 30 g; phloem (bark of the stems) 25 g; bark of the roots, 15 g; their moisture contents being determined simultaneously. The samples were extracted exhaustively with chloroform and benzene and then with 70% aqueous methanol by steeping at room temperature for 2 h. The solutions were evaporated in a rotary evaporator at 40-45°C. For PC we used Fin-11 paper by the ascending method in systems 1) butan-1-ol—acetic acid—water (40 : 12 : 28), and 2) 2% acetic acid. The chromogenic agent was a 1% solution of vanillin in concentrated hydrochloric acid. IR spectra were taken on a UR-10 instrument (tablets with KBr), angles of rotation were determined in an or-

dinary polarimeter (c 0.65-0.1), and melting points in an instrument containing concentrated sulfuric acid. The elementary analyses of all the compounds corresponded to the calculated figures.

SUMMARY

The amounts of flavan substances and their qualitative compositions in various organs of *Hibiscus cannabinus* according to vegetation periods have been established.

In all vegetation periods, flavan compounds are formed in the phloem and roots of kenaf; their amount reaches a maximum in the flowering period and becomes almost constant by the moment of harvesting. Among the monomeric flavans, (−)-epicatechin predominates.

(−)-Epicatechin gallate, (+)-catechin, (−)-epigallocatechin gallate, and (−)-epicatechin have been identified in the products of hydrolysis of the tannin.

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ESSENTIAL OIL OF *Artemisia scoparia*

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The chemical composition of the essential oil of oriental wormwood growing in Kazathstan has been investigated. Of the components of the oil, 28 have been identified, and the structure of an acetylenic hydrocarbon has been refined.

Oriental wormwood (*Artemisia scoparia* W. et K.) is widely distributed in the lower European part of the USSR, Kazakhstan, Central Asia, Asia Minor, Western and Eastern Siberia, in the Maritime Territory, Manchuria, and Mongolia. It grows on the steppes and in deserts, in river valleys, and also in the low mountain zone.

The essential oil is present in the roots and epigeal part of the plant. The epigeal part contains about 1% of essential oil which, depending on the regions of growth of the wormwood, is subject to considerable quantitative and qualitative changes [1]. This species of wormwood has been used in folk medicine from ancient times [2, 3]. The broad action of the essential oil of the oriental wormwood has attracted attention and it has been studied repeatedly [4-7]. In the publications cited, the phases of development of the plant and the various methods of extracting the essential oils and investigating them are not stated. This possibly explains the diversity of the compositions of the essential oils.

We have investigated the essential oil of oriental wormwood obtained from plants collected in the Samarskoe district, East Kazakhstan province, in the budding phase. The oil contained a considerable amount of scoparone, some of which deposited on prolonged standing (mp 143-144°C). The phenol fraction, consisting of thymol, cis- and trans-eugenols, also contained 2-acetoxy-4,5-dimethoxycinnamic acid (mp 198-199°C), which is formed from scoparone

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