A STUDY OF THE CHEMICAL COMPONENTS OF THE ROOTS OF *DECALEPIS HAMILTONII*

Part III. Comparison with *Hemidesmus indicus* (Indian Sarsaparilla)

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The general chemical composition of the roots of *Decalepis Hamiltonii* has been described in Part I.[1] Since *Hemidesmus indicus* belongs to the same family (Asclepiadaceæ) and resembles the *Decalepis* in smell and in taste it has been felt necessary to examine this root also on the same lines and compare the nature of the various components. The only systematic work done so far on this drug is that of Dutta, Ghosh and Chopra.[2] According to them the chief constituents of the root are (1) an essential oil 0·225% on the weight of the air-dried root consisting of *para*-methoxysalicylicaldehyde, (2) two sterols, Hemidesterol melting at 182–84° having the formula $C_{34}H_{60}O$ and Hemidesmol melting at 161° and having the formula $C_{33}H_{58}O$, (3) two amorphous resin acids one melting at 155–58° and the other at 128–30°, and (4) a small amount of an indefinite glucoside melting at 133–36° besides tannins and resins.

When we examined the roots of *Hemidesmus indicus* on the same lines as we have adopted for *Decalepis Hamiltonii* the results indicated that both the roots are very similar in the nature of the components ; this is brought out in the accompanying table. It may be stated in general that in the case of *Hemidesmus indicus* the yields are much poorer as compared with *Decalepis Hamiltonii*. For example *p*-methoxysalicylicaldehyde exists in the latter to the extent of 0·8% on the weight of the dried roots whereas in the former it forms only 0·12%. Consequently the *Decalepis* should be more serviceable for the purposes for which the *Hemidesmus* is employed.

In regard to the differences in the findings of Dutta, Ghosh and Chopra and those recorded in this paper, it seems probable that what the previous workers considered to be sterols were really mixtures of the resinols with smaller quantities of phytosterols. In an experiment carried out by us following their method of extraction it was found possible to isolate the various non-sterol fractions already mentioned. These do not give the correct reactions of sterols but give positive tests for resinols.

TABLE I

D. Hamiltonii			*Hemidesmus indicus*		
Nature of the fractions and melting point	Liebermann-Burchard reaction	Derivatives melting point	Nature of the fractions and melting point	Liebermann-Burchard reaction	Derivatives melting point
Petroleum Ether Extract—			*Petroleum Ether Extract—*		
1. Resinols			Resinols		
(*a*) 235°	Pink	No acetate	235°	Pink	No acetate
(*b*) 175–85°	,,	Acetate 212–18°	175–85°	,,	Acetate 210–15°
(*c*) 160–65°	,,		165–70°	,,	
(*d*) 155–57°	,,		155–65°	,,	
(*e*) 151–53°	,,		150–54°	,,	
(*f*) 135–45°	,,		135–40°	,,	
2. Sterols 105–10°	Pink-blue-green	Acetate 130–60°	105–10°	Pink-blue-green	Acetate 130–60°
3. Ketone 83°	Nil	Oxime 68°	Ketone 83°	Nil	Oxime 68°
4. Aldehyde 42°			Aldehyde 42°		
5. Fatty acids (solid) 80–82°	(Sap. equivalent 360)		Fatty acids (solid) 80–82°	(Sap. equivalent 352)	
Alcohol Extract—			*Alcohol Eextract–*		
1. Inositol 221°					
2. Crystalline resin acid 245°					
3. Amorphous resin acid 180°			Amorphous resin acid 160°		
4. Saponins			Saponins		
5. Tannins			Tannins		

Experimental

Fresh material (*Hemidesmus* roots) for the examination was obtained locally. The roots were small in size when compared with those of *Decalepis Hamiltonii.* As ordinarily employed, portions of the stem are also mixed up with the roots. Four kilograms of the air-dried powdered material were

extracted just in the same way as in the case of *Decalepis Hamiltonii* and the extracts examined. Here too the petroleum ether and alcohol extracts formed the most prominent bulk and hence these solvents only were used.

The petroleum ether extract contained a little chlorophyll in addition to other substances. Though it could be separated into the four fractions as in the case of the *Decalepis Hamiltonii* by the treatment of the semi-solid residue with alcohol and subsequent careful concentration, fractions (W) and (A) were mixed together for the sake of convenience and thus division into three main fractions was made for detailed study. The first fraction (48 g.) corresponded to the wax (W) and fraction (A) of *Decalepis Hamiltonii*. This was subjected to saponification and the unsaponifiable matter fractionated as before. The other two fractions corresponded to (B) and (C). The following table sums up the results of the study of the fractions.

TABLE II

Fractions melting point	Yield	Colour reactions	
		Liebermann-Burchard	Hesse
From (W + A)			
1. 83° (Ketone)	0·5 g.	Nil	Nil
2. 175–85° (Resinols)	1·5 g. (acetate, m.p. 210–15°)		
3. 165–70° ,,	2·0 g.		
4. 155–65° ,,	4·0 g.	Pink	Yellow
5. 150–54° ,,	2·5 g.		
6. 135–40° ,,	2·5 g.		
7. 105–110° (Sterols)	1 g. (acetate, m.p. 130–60°)	Pink-blue-green	Red
From (B) and (C)			
8. 235° (Resinols)	0·3 g.	Pink	Yellow
210–22° ,,			
9. Aldehyde			

The unsaponifiable matter from fraction (W + A) gave only a deep pink colour when the mixture was tested with the Liebermann-Burchard reagent. This can be explained as due to the predominant presence of resinols in the

mixture. When this was fractionated just as in the case of *Decalepis Hamiltonii*, the ketone melting at 83° separated out. Then the resinols melting between 135–185° were systematically fractionated and they all gave the pink colour with the Liebermann-Burchard reagent and yellow colour with Hesse's reagent. The final mother liquor, after careful manipulation as described already, gave a very small quantity of a colourless solid which gave the play of colours, pink-blue-green and a blood red colour with the Hesse's reagent characteristic of sterols. The final yellow residue was acetylated as before and a sterol acetate mixture melting at 130–60° was obtained and is under study. The above fractions were found to be very similar to the corresponding fractions of *Decalepis Hamiltonii.*

From the fraction (B) of the petrol extract the compound melting at 235° was isolated by adopting the same procedure as described under *Decalepis Hamiltonii.* The samples from the two sources were found to be identical since they gave the same colour reactions and the mixed melting point was undepressed.

As a typical member of the group the fraction melting at 175–85° was acetylated with acetic anhydride and sodium acetate in the usual way. The separated solid was recrystallised from alcohol-acetone mixture when a needle-shaped crystalline substance melting at 210–15° was obtained. This was found to be similar with the acetate (m.p. 212–15°) obtained from the fraction melting at 170–85° of *Decalepis Hamiltonii.* The mother liquor after the separation of the acetate melting at 212–15°, yielded another fraction melting at 175–80°.

The soap obtained from the saponificatin of the (W + A) fraction was decomposed and studied just as before. The aggregate of the mixed fatty acids obtained weighed 10·5 g. of which the solid acids amounted to 7 g. They melted at about 80° and had a saponification equivalent equal to 352.

Fraction (C) yielded about 8 g. of an essential oil. The *para*-methoxysalicylicaldehyde in this case was best obtained by steam distillation since the presence of chlorophyll rendered purification by recrystallization very difficult. The yield of the aldehyde was about 6 g. (0·12%).

After petrol extraction, the residue (root powder) was extracted in the same apparatus with alcohol exhaustively. A detailed study of the alcoholic extract revealed the presence of saponin, and tannin in much smaller amounts along with the resin acid melting at about 160°. The presence of the crystalline acid melting at 245° (cf. *Decalepis Hamiltonii*) and of inactive inositol could not be detected.

A separate experiment employing direct hot alcoholic extraction of the dry root powder was made. On concentrating the extract to half the bulk and cooling, a colourless solid mixed with chlorophyll was obtained. This was found to consist mostly of wax very similar in properties and composition to the wax obtained by petroleum extraction. By further fractionation of the mother liquor the crystalline solid melting at 235° along with the related lower fractions found in (B) were obtained. A small quantity of the resinols melting above 130° corresponding to fraction (A) could also be isolated.

Summary

The roots of the *Hemidesmus indicus* were studied on the lines adopted for *Decalepis Hamiltonii* and were found to have a similar composition particularly with regard to the petrol extract. Since the *Decalepis* roots contain much higher percentages of the various chemical components they are more suitable for use as drug.

REFERENCES

1. Murti and Seshadri .. *Proc. Ind. Acad. Sci.* (A), 1941, **13**, No. 2, 221.
2. Dutta, Ghosh and Chopra *Arch. Pharm.*, 1938, **276**, 333–40.