with axial ratio. For example, the lowest value of axial ratio, 0·441154, is for yellow-green tourmalines, and the highest value, 0·454079, is for the yellow-tourmalines. Since crystals with the rhombohedral terminations are not found in the tourmaline under study, it is not possible to calculate its axial ratio. Therefore its relation to the colour cannot be determined.

Guido Carobbi and Renzo Pieruccini[4] correlate the colour of tourmalines with the value of double refraction; as for example $\omega-\varepsilon=0\cdot0200$ is associated with pink, 0·0204 with colourless, and 0·0220 with greenish-yellow tourmalines. Here the value is 0·0255 and according to Winchell, this is towards the green and the blue tourmalines.[5]

From the spectrographic study, they find that lithium and copper are present in almost all samples of tourmalines from the Island of Elba and that the latter is greater in quantity in the blue crystals. As regards the blue crystals from Elba, it is suggested that copper and lithium substitute for magnesium as an isomorphous substitute. It also stated that copper in minute traces is a common substitute for the isomorphous group Mg-Fe" in the silicates of the rocks. It is therefore suggested that in the tourmaline under study, lithium and copper have substituted the Mg-Fe" of a Ferro-Magnesium mineral.

Scharizer[6] and T. W. Warner[7] have attributed that the change in colour of tourmaline is mainly due to the presence of minor constituents. G. Carobbi and R. Pieruccini state that the blue colour of tourmaline is due to the presence of copper and particularly due to the strongly deforming action of Cu".

The sample of the tourmaline under study was kindly analysed spectrographically by Dr. R. S. Krishnan, Department of Physics, Indian Institute of Science, Bangalore, and showed the following elements:

B, Si, Al, Fe, Mg, Cu, K, Na, & Li.

Winchell classifies the tourmaline series into Dravite-Schorlite and Schorlite-Elbaite series, the distinction between the two series being based on the presence of lithium in the Schorlite-Elbaite series and the absence of it in the Dravite-Schorlite series. Accordingly Dr. C. S. Pichamuthu[8] describes a tourmaline from Yenneholeranganbetta as belonging to the Schorlite-Elbaite series. In regard to colour, Winchell distinguishes the Dravite-Schorlite series as being brown, less commonly blue or green to black; and Schorlite-Elbaite series as black to delicate tints of pink, green or yellow.

Since according to the analysis of Dr. Krishnan, a persistent line of lithium has been indicated at λ6708Å the tourmaline of Devarnarsipur must be regarded after Winchell as belonging to the Schorlite-Elbaite series. But on the basis of the scheme of colour given by him, it should be put into the Dravite-Schorlite series. In view of the fact that T. W. Warner and G. Carobbi have now recently shown that lithium is present in all tourmalines and cannot therefore be a distinguishing criterion for classification, it is obvious that on the basis of the colour scheme the Devarnarsipur tourmaline should be placed in the Dravite-Schorlite series. This view is also in accordance with the fact that the copper is replacing the Mg-Fe" of the mineral and gives the blue colour associated with the Dravite-Schorlite series.

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Bangalore, *July* 6, 1949.

1. *Curr. Sci.*, November 1948, **17**, 330. 2. "Elements of Opt. Mineralogy," Part II, 1933, 303. 3. *American Mineralogist*, Mar.—Apr. 1947, **32**, 121. 4. *Op. cit.*, p. 121. 5. "Elements of Opt. Mineralogy," Part II, 1933. 6. *American Mineralogist*, March—April 1947, **32**, 128. 7. *American Mineralogist*, 1935, **20**, 531. 8. *Curr. Sci.*, 1944, **13**, 279.

CHEMISTRY OF SUGARCANE JUICE IN RELATION TO MANUFACTURING QUALITIES—A STUDY WITH SPECIAL REFERENCE TO THE OPEN PAN INDUSTRY

THE important bearing of non-sugars on the manufacturing qualities of sugarcane juices is familiar in vacuum pan practice. Kortscher[1] discusses the injurious effects of various organic non-sugars in the colloidal state and Alvarez[2] connects superior factory quality with smaller amounts of gums and albuminoids. The so-called "harmful" nitrogen compounds[3], comprising amino acids, organic bases etc., are commonly regarded as very undesirable. Various evil effects are also attributed to different mineral constituents, such as Silica, iron, alumina and magnesia [2,4]. Gomez and Boon[5] mention the existence of silica in the form of soluble sili-

cates as well as complex organo-siliceous compounds, the later class being also recognised by Muller.[6] Davis[7] makes the definite observation that organic silica is inversely proportional to juice "claribility". The question of phosphates has engaged the attention of workers in many countries, with particular reference to the variety POJ 2878, the manufacturing difficulties commonly observed being sometimes traced to phosphate deficiency[4,8,9,10,11,12,13] though not always explained on this basis [14,15,16,17,18]. Effective phosphates have been postulated such as phosphates present as phosphoric acid,[19] or those in true solution.[20] Davis (*loc. cit.*) discovers a characteristic phosphate status in the clarified juice of a variety (leading to possibilities of organo-phosphates) and concludes that a better criterion is the residual phosphate level or the amount of phosphates eliminated.

The part played by non-sugars under the drastic treatments of the white sugar factory being thus clear, their greater importance in the open pan system need hardly be stressed. Large varietal differences in gur quality are a matter of common experience, marked variation in respect of non-sugars in juices of different varieties having also been observed.[21,22,23] It, therefore, becomes important to evaluate varieties for the open pan industry with regard to the nature and extent of non-sugars in their juices as also to assess the role of these ingredients in determining quality of the product.

In these experiments, eight important cane varieties (in four replications) were examined, the juices being analysed for Pol, reducing sugars, total colloids, gums, pectin, total organic nitrogen, "harmful" nitrogen, ash, SiO_2, $Fe_2O_3+Al_2O_3$, CaO, MgO and P_2O_5. Most of the analytical methods have been referred to in previous communication,[24] "harmful" nitrogen being estimated by the method of Unverdorben and Spielmeyer.[25] Gur was prepared from each juice under rigidly standardised conditions (striking point : 118° C.), which were considered satisfactorily reproducible, as evident from—(*i*) Uniform temperature gradients (measured from 105° C onwards) in all cases, (*ii*) constancy in gur/juice ratios in respect of Pol, reducing sugars and ash for all pans boiled, (*iii*) constancy of the ratio between colorimetric index per 100 Bx. in gur (measured in standard solution) and the same quantity for juice, for a particular variety and juice treatment. A classification of the gur samples (on general features ,Pol, reducing sugars, ash, nett rendements, colour, acidity and insoluble matter) distinctly pointed to Co's 313 and 513 as good gur varieties, Co 453 as poor, the rest being medium.

Analytical data pertaining to the juices revealed striking differences between Co's 313 and 513 on the one hand and Co 453 on the other, the behaviour of the rest being intermediate between the two. Thus, Co 453 juices (poor) on an average, showed higher values for the undermentioned ingredients or ratios over those of Co's 313 and 513 (good), the order of percentage difference being shown against each in brackets:

(*i*) Total colloids (130), (*ii*) Ash (40), (*iii*) Ash in colloids/Total ash (50), (*iv*) Gums (70), (*v*) Pectin (80), (*vi*) Harmful N (60), (*vii*) Harmful N/Total organic N (75), (*viii*) Soluble SiO_2 (145), (*ix*) $Fe_2O_33+Al_2O_3$ (100), (*x*) CaO (80), (*xi*) MgO (50).

In contrast to the above, Co 453 juices exhibited lower values for P_2O_5 content, being of the order of 30 per cent. below those for Co's 313 and 513. The important role of non-sugars in the open pan industry is thus clearly brought out. Further work is in progress.

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May 25, 1949.

1. Kortscher, *Hawaiian Planters' Record*, October 1939, **43**, No. 1. 2. Alvarez, *Revista Ind. Agricola Tucuman*, 1938. **27**, 111. 3. Browne and Zerban, *Sugar Analysis* (New York), 1941, p. 1086. 4. Parashar, Kripashankar and Lal, *Proc. Ind. Sci. Congr.*, Discussions, 1947. 5. David, Gomez and Boon, *Internat. Sug. Jour.*, 1938, **40**, 105. 6. Muller, *Ibid.*, 1921, **23**, 579. 7. Davis, *Ibid.*, 1939, **41**, 463 ; *Trop. Agri.*, March 1940, **17**, No. 3. 8. McCleery, *Rept. Exp. Sta. Hawaiian Sug. Planters' Assoc.*, 1933, 36. 9. Hadfield, *Hawaiian Planters' Record*, 1934, **38**, 126. 10. Fleshman, *Rept. Assoc. Hawaiian Sug. Tech.*, 1936, 121. 11. Caminha, F., *Brazil*

Azuc., 1035, **4**, 335. 12. Davis, *Internat. Sug. Jour.*, 1937, **39**, 67. 13. Springer, *Proc. Jamaican Assoc. Sug. Tech.*, 1937, **1** (2), 30. 14. Davis, Duncan and Yearwood, *Internat. Sug. Jour.*, 1936, **38**, 299. 15. —, *Proc. 6th Congr. Int. Soc. Sug. Tech.*, Louisiana, 1939. 16. Pocy, F. *Cuba Agricola*, 1934, **1** (8), 11. 17. *Guillaume, Proc. Assoc. Tech. Azuc., Cuba.*, 1939, **9**, 65. 18. Birkett, *Trop. Agri.* 1940, **17**, 12, 233. 19, Beater, *Proc. 11th Ann. Congr., S. African Sug. Tech. Assoc.*, 1937, 82. 20. Gundu Rao and Kripashankar, *Proc. Ind. Sug. Tech. Assoc.*, 8th Conv., 1939. 21. Ramanaya and Vishwanath, *Ibid.*, 4th Conv., 1935. 22. —, *Ibid.*, 5th Conv., 1936. 23. Ramanaya and Satyanarayana, *Ibid.*, 7th Conv., 1938. 24. Khanna and Chacravarti, *Curr. Sci.*, 1949, **18**, 19. 25. Unverdorben and Spielmeyer, *Zeit. Ver. Deut. Zuckerind*, 1939, **89**, 616.

PRECIS ORITHYA SWINHOEI L. (FAM. NYMPHALIDAE), FEEDING ON *STRIGA* Spp.-THE PHANEROGAMIC PARARSITE OF SUGARCANE AND JOWAR

IN 1946 August, one of us (D.V.M.) noticed a number of butterfly caterpillars feeding on *Striga-Spp.*—*a* root parasite of sugarcane and jowar in this tract. The caterpillars on rearing emerged into butterflies, provisionally identified as "*Precis Orithya Swinhœi*" L., popularly known as "Blue Pansy". During the same period the caterpillars were noticed on *Striga* in some of the sugarcane plots at Rudroor, and later during winter months, at Bodhan and nearby places.

Striga Spp.—the root parasite of sugarcane is a fairly serious pest in the Nizamsagar tract and during August 1939, Rai Saheb Prof. L. S. S. Kumar of the Bombay Agricultural Department, visited the area on tour and suggested various remedial measures for the eradication of the pest. In his report[1] he alludes of having noticed a butterfly caterpillar feeding on *Striga densioflora*. It is not known whether it is the caterpillar of *Precis Orithya Swinhœi* L. he is referring to.

The butterfly, though observed all the year round, is abundant only during the winter months. The seasonal distribution is as follows (see Table I).

During the months of December 1948 and January (1949), when rearing was done in the laboratory, its life-history was as follows:

Egg period 4-5 days, Larval period 10-15 days and the Pupal period 10-12 days. The meteorological data in the laboratory where rearing was done is given in Table II.

TABLE I

Month	Caterpillars collected during field observations round about Bodhan	Butterflies noticed
October	22	In few numbers
November	120	In large numbers Flitting during midday & copulating
December	112	Do
January	53	In few numbers
February	12	Do. Observed on *Striga* in *Rabi* jowar plots
March	nil	In very few numbers
April	3	In negligible numbers
May-October	Almost nil	In very negligible numbers

TABLE. II

Average meteorological data of the Laboratory where rearing was done

Month	Maximum Temp.	Minimum Temp.	Humidity
December '48 ..	78·3° F.	72·2° F.	65
January '49 ..	78·9° F.	70·9° F.	66

The eggs of the butterfly are laid singly on tender leaves and buds and the caterpillar feeds on them. However the caterpillar is not a voracious feeder. The effectiveness of the butterfly in reducing infestation of *Striga* is being worked out.

Apart from the above a few more insects on *Striga* have been observed. Investigations will be carried as and when opportunity arises.

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1. Kumar, L. S. S. "Report, regarding his visit to H. E. H. the Nizam's Dominions to enquire into the Attack of the Parasitic Flowering Plant *Striga* on Sugarcane and Jowar (Unpublished), 1939.