longer wavelengths, $\omega_e'$ is less than $\omega_e''$ by about two wavenumber units. The separation between R and Q heads in each band is observed to be large (about 28 $cm^{-1}$). The large separation is due to the fact that the B' and B" values in the upper and lower states are almost equal. The two groups of bands shown in strip (*e*) of Fig. 1 are interpreted as the R and Q heads of the second multiplet component of the $^4\Pi$–$^4\Sigma$ transition. The two remaining component systems are not observed in system B of HfI. As the corrresponding heads (Q and R) in each component system are separated by a wavenumber interval of 183 $cm^{-1}$ the coupling constant A in the upper $^4\Pi$ state is about 183 $cm^{-1}$ No outside sequences of $\Delta v = \pm 1$ are observed because of the near equality of $B_e$ and $r_e$ values in the upper and lower states. The measurements and classifications of the band heads are given in Table II.

TABLE II

*List of vacuum wavenumbers and intensites of band heads in system B of HfI*

| Wavenumber $cm^{-1}$ | Intensity I* | Classification |
|---|---|---|
| 20501·0 R | 10 | 4, 4 |
| 04·0 R | 10 | 3, 3 |
| 06·4 R | 9 | 2, 2 |
| 08·1 R | 10 | 1, 1 |
| 08·8 R | 9 | 0, 0 |
| 31·4 R | 8 | 4, 4 |
| 33·3 R | 7 | 3, 3 |
| 34·4 R | 7 | 2, 2 |
| 35·8 R | 7 | 1, 1 |
| 37·4 R | 7 | 0, 0 |
| 20693·2 | 3 | 1, 1 |
| 95·5 | 4 | 0, 0 |
| 715·4 | 5 | 1, 1 |
| 17·8 | 5 | 0, 0 |

* The intensities quoted here are visual estimates based on a scale 0–10.

R—Degraded to Red.

One might consider the two component systems belonging to a transition of the type $^2\Pi$–$^2\Sigma$ with a doublet separation of 183 $cm^{-1}$ for the upper $^2\Pi$ state. Such a transition was not however observed in the spectra of TiBr, ZrBr and ZrI. Instead, system ascribed to $^4\Pi$–X $^4\Sigma$ has been observed. It appears therefore reasonable to attribute that the two systems arise from two components of a $^4\Pi$–$^4\Sigma$ transition.

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Physics Department,
Andhra University,
Waltair (India),
*July* 31, 1971.

T. SAVITHRY.
D. V. K. RAO.
P. T. RAO.

1. Sivaji, Ch. and Rao, P. T, *Proc. R. Ir. Acad.*, 1970, **70 A, 1.**
2. — and —, *J. Phys.* (Lond.), 1970, **3 B,** 720.
3. —. Rao D. V. K. and Rao, P. T., *Curr. Sci.*, 1970, **39,** 153.
4. Carroll, P. K. and Daly, P. J, *Proc. R. Ir. Acad.*, 1961, **61 A,** 101.

## A RAPID METHOD FOR *DETERMINATION OF TISSUE* POTASSIUM IN ARECANUT

ABSTRACT

The efficiency of different extractants which included cold water, hot water, salt solutions, chelate and dilute acid to extract potassium from areca leaf was compared with the wet oxidation procedure. Amongst the various extractants employed, hot water gave the best result. Hot water also eliminates the possibility of contamination from impure chemicals. The method is rapid, handy, accurate and inexpensive.

EXTRACTION of potassium from plant tissue is usually made by wet oxidation, dry ashing and direct leaching with ammonium acetate. The element extracted is estimated either by flame photometry or conventional cobaltinitrite method. There are certain serious drawbacks associated with these two procedures of ashing. Loss of considerable amount of potassium takes place at the temperature range of 550°–600° C while dry ashing. Although the same could be avoided at lower temperature of 400°–450° C, the method is time-consuming. The wet ashing procedure requires special fume exhaustion arrangements for carrying out the digestion. In view of these difficulties, it is desirable to choose the leaching method of extraction. This would enlarge the scope of handling more number of samples per day.

Jackson[1] proposed the use of 2 *N* $NH_4$ OAc + 0·2 *N* Mg $(OAc)_2$ as the solution for extraction of potassium from plant tissue. We in this laboratory attempted to evaluate the potassium extracting abilities of several extractants namely, water, hot water, acidified water of pH 4·5, 2 *N* $NH_4$OAc, 2 *N* Mg $(OAc)_2$, 2 *N* $NH_4$ OAc + 0·2 *N* Mg $(OAc)_2$, 0·02 *M* di-sodium EDTA, 0·1 *N* HCl from tissue samples in relation to the wet oxidation method which was considered as the standard. The ratio of tissue to extraction solution employed was 1 : 200. The leaf samples used in the present study were collected from the NPK manurial experimental area of

TABLE I

*Comparison of different extraction procedures for potassium in areca leaf*

(Results expressed on oven dry basis as percentage of K)

| Sample No. | Wet oxidation | Water | Hot water | Water pH 4·5 | 2*N* $NH_4OAc$ | 2*N* $Mg(OAc)_2$ | 2 *N* $NH_4OAc$ + 0·2 *N* $Mg(OAc)_2$ | 0·02*M* EDTA | 0·1*N* HCl |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0·79 | 0·75 | 0·76 | 0·69 | 0·68 | 0·60 | 0·65 | 0·66 | 0·79 |
| 2 | 0·76 | 0·78 | 0·70 | 0·71 | 0·71 | 0·64 | 0·66 | 0·70 | 0·61 |
| 3 | 0·52 | 0·50 | 0·48 | 0·44 | 0·44 | 0·40 | 0·44 | 0·49 | 0·41 |
| 4 | 0·52 | 0·51 | 0·53 | 0·47 | 0·48 | 0·42 | 0·48 | 0·46 | 0·44 |
| 5 | 0·98 | 0·92 | 0·96 | 0·91 | 0·85 | 0·82 | 0·87 | 0·85 | 0·79 |
| 6 | 0·79 | 0·72 | 0·79 | 0·74 | 0·66 | 0·63 | 0·71 | 0·71 | 0·62 |
| 7 | 0·68 | 0·64 | 0·66 | 0·63 | 0·61 | 0·56 | 0·61 | 0·61 | 0·51 |
| 8 | 0·98 | 0·94 | 0·98 | 0·89 | 0·85 | 0·81 | 0·90 | 0·88 | 0·81 |
| 9 | 1·16 | 0·98 | 1·04 | 1·06 | 0·96 | 0·90 | 1·02 | 1·02 | 0·94 |
| 10 | 0·50 | 0·42 | 0·49 | 0·44 | 0·48 | 0·42 | 0·44 | 0·44 | 0·40 |
| 11 | 1·21 | 1·13 | 1·26 | 1·17 | 1·11 | 1·04 | 1·15 | 1·15 | 1·08 |
| 12 | 1·10 | 0·98 | 1·09 | 1·04 | 0·98 | 0·94 | 1·01 | 1·00 | 0·93 |
| '*t*' value: | | 4·140 NS | 1·733 NS | 10·941* | 6·020‡ | 10·951* | 9·798* | 8·373* | 8·086* |

* Significant at 0·1% level of probability, NS = Non-significant.

the Institute, oven-dried and ground by a rotary mill. A 0·5 g of the tissue sample was treated with 100 ml of the extractant solution and shaken for 1 hr. In the case of wet ashing method, the same weight of the leaf material was pre-digested with nitric acid over a water-bath and subsequently treated with 10 ml of 1 : 1 nitric to perchloric acid mixture till the content was clear and just moist (Perur, personal communication). In all the cases, from an aliquot potassium was read by Systronix flame photometer.

The results of the study are summarized in Table I along with the statistical constants. Potassium extracted by water and hot water did not differ significantly from that of wet oxidation method. However, when the paired 't' values were compared, out of all hot water was found to be the most suitable extractant.

The efficiency of water to extract potassium from plant sample is an established fact. Potash-free ash is obtained when the plant tissue is extracted with cold water[2]. This is possible because the potassium in plant cell is mostly present in the form of inorganic compounds and salts of organic acids. The superior performance of hot water over cold appears to be due to the greater solvent property of the former. Besides, hot water may expand the cell walls of the tissue and make them more permeable. The proposed method is simple, handy, rapid and may be useful for the routine analysis when problems exclusively relating to potassium nutrition of crops are involved.

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Department of Soils,
Central Plantation Crops
Research Institute,
Regional Station, Vittal,
*May* 7, 1971.

A. R. MOHAPATRA.
N. T. BHAT.
V. O. ABOOBAKER.

1. Jackson, M. L., *Soil Chemical Analysis*, Prentice-Hall of India, Private Ltd., New Delhi, 1967, p. 333.
2. Miller, E. C., *Plant Physiology*, McGraw-Hill Book Company, Inc., New York and London, 1938, p. 317.

## ON THE OCCURRENCE OF AN INTERSEXUAL FORM AND POSSIBLY A NEW SPECIES OF *APHELENCHOIDES* FISCHER (NEMATODA : TYLENCHIDA)

OCCURRENCE of intersexes in nematodes is known in relatively few genera. In the order Tylenchida, it has been reported only thrice (Chitwood, 1949 ; Hirschmann and Sasser, 1955 ; Triantaphyllou, 1960). This is the fourth record of an intersex in Tylenchida and the first in the genus *Aphelenchoides* Fischer, 1894.

Except in *Meloidogyne* spp., the intersexes in all other groups of nematodes have been females which showed secondary male characters. These intersexes had well-developed female gonad (s) with duct (s), vagina and vulva. In addition, they possessed male sexual opening, spicules, cloacal papillae, etc.

The male intersexual form was first reported by Chitwood (1949) in *Meloidogyne javanica* (Treub). Triantaphyllou (1960) found that the male intersexes of *M. javanica* and