Plant Archives Vol. 14 No. 1, 2014 pp. 111-114 *ISSN 0972-5210*

STANDARDIZATION FOR X-RAYS OF WILD FOREST SEEDS FOR MORPHOLOGY AND VIABILITY STUDIES

R. N. Nakar* and B. A. Jadeja

Department of Botany, M. D. Science College, Porbandar - 360 575 (Gujarat), India.

Abstract

Standardization of wild seeds of 98 species was carried out using radiography techniques with low doses of X-rays to study morphology and viability. Among 98 species, all seeds were with no cracks or damage hence viable after 20 days of collection from Girnar Reserve Forest, Junagadh ($70^0$28' to 70^0 27' N latitude and $21^0$30' to $21^0$26' E longitude) from different areas like Jatashankar forest, Bordevi forest, Datar forest, Bharatvan-Sheshavan forest, Jhinababani Madhi forest, Sharakadiya Hanuman area forest, Kashmiri bapu Ashram area forest, area near Gayatri Mandir and other surrounding areas during 2008-09. Soft X-rays, which are used in mammography studies, can be utilized for identification of healthy seeds. X-ray photography with their output for morphology, viability and health are described and discussed.

Key words : Morphology, wild forest seeds, mammography, radiography techniques.

Introduction

Good seed quality is the guarantee high performance. That is why the quality tests carry great importance in seed science. Nevertheless, they only offer information on the germination percentage or the degree of purity of the sample. Thus, seed X-rays are quite useful to provide information about the quality of seeds, which consists of the visualization of the internal seed structure on an X-radiograph. The X-ray test is a quick, non-destructive method to evaluate seed quality (ISTA, 1976). The X-ray images of seeds give insight information about their not only morphology and development, but also on the deformations of the embryo and thus viability percent also. The micro-fractures, endosperm filled and its density, mechanical, physical, and insect damages are visible, if provided proper dose of radiation. Percentage of empty seeds, percentage of seed endosperms without embryo, developmental stages, poorly filled seeds to well developed seeds can easily be identified using the technique.

Materials and Methods

Seeds of 98 different species including 64 trees, 28 herbs, 5 shrubs and 3 climbers were collected during 2008-09 from Girnar Reserve Forest, Junagadh ($70^0$28' to $70^0$27' N latitude and $21^0$30' to $21^0$26' E longitude) from different places like Jatashankar forest, Bordevi forest, Datar forest, Bharatvan-Sheshavan forest, Jhinababani Madhi forest, Sharakadiya Hanuman area forest, Kashmiri bapu Ashram area forest, forest area near Gayatri Mandir and other surrounding areas of forest. After collecting seeds in paper bags, they were brought to laboratory, where they were cleaned for soil particles and finally fixed to paper sheet of 12 × 14 cm prepared for X-rays. 100 seeds of individual species were used to get exact detail regarding seed health and morphology at Gujarat Cancer Research Institute, Ahmadabad, Gujarat. Using equipment Siemens mammomat 1000, which is generally used for mammography and other clinical studies, we tried to obtain X-rays with good contrast and full resolution by providing different doses of radiation, standardized doses for different groups of plants.

Results and Discussion

Most of the tree seeds were observed with standard dose of 20 to 22 KV for different groups of plants. Trees and shrubs seeds could be visualized under average of 22 KV radiation dose while seeds of climbers and herbs gave good contrast and resolution against 20 KV radiation dose. In earlier time, Huss (1951) gave detailed description regarding different characters like micro fractures,

***Author for correspondence :** Present address- Research Associate, Central Arid Zone Research Institute, Kukma (Bhuj) - 370 105 (Gujarat), India. E-mail: rupeshnakar@gmail.com

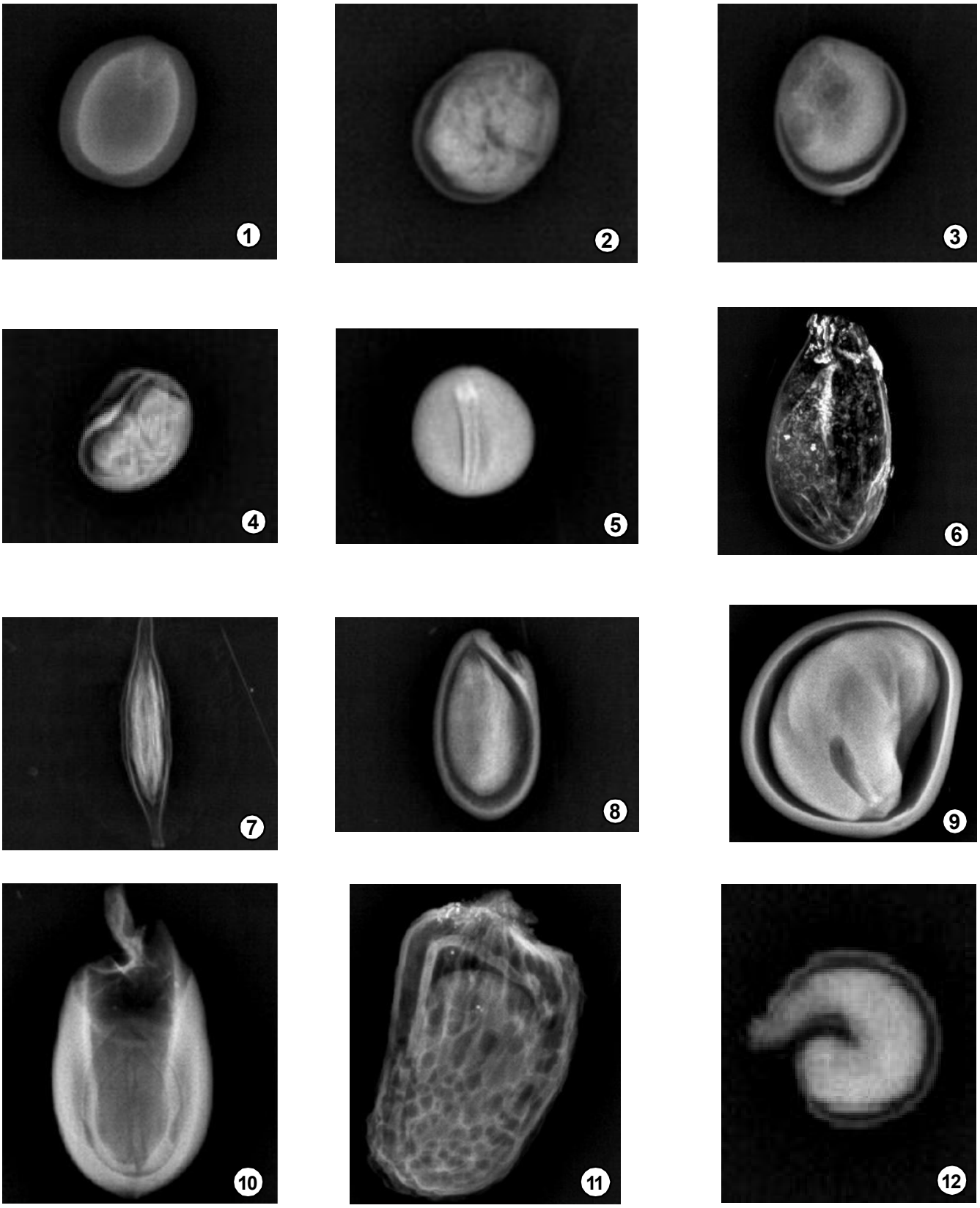

Fig. 1 (A) : Visualization of some seeds after exposing soft X-rays [A: 1 to 12].
1 to 12 : where, **1** = *Albizia lebbeck*, **2** = *Bombax ceiba*, **3** = *Sterculia urens*, **4** = *Ceiba pentandra*, **5** = *Cassia siamea*, **6** = *Madhuca indica*, **7** = *Terminalia arjuna*, **8** = *Mimusops elengi*, **9** = *Caesalpinia crista*, **10** = *Gmelina arborea*, **11** = *Semecarpus anacardium*, **12** = *Cretiva nurvala.*

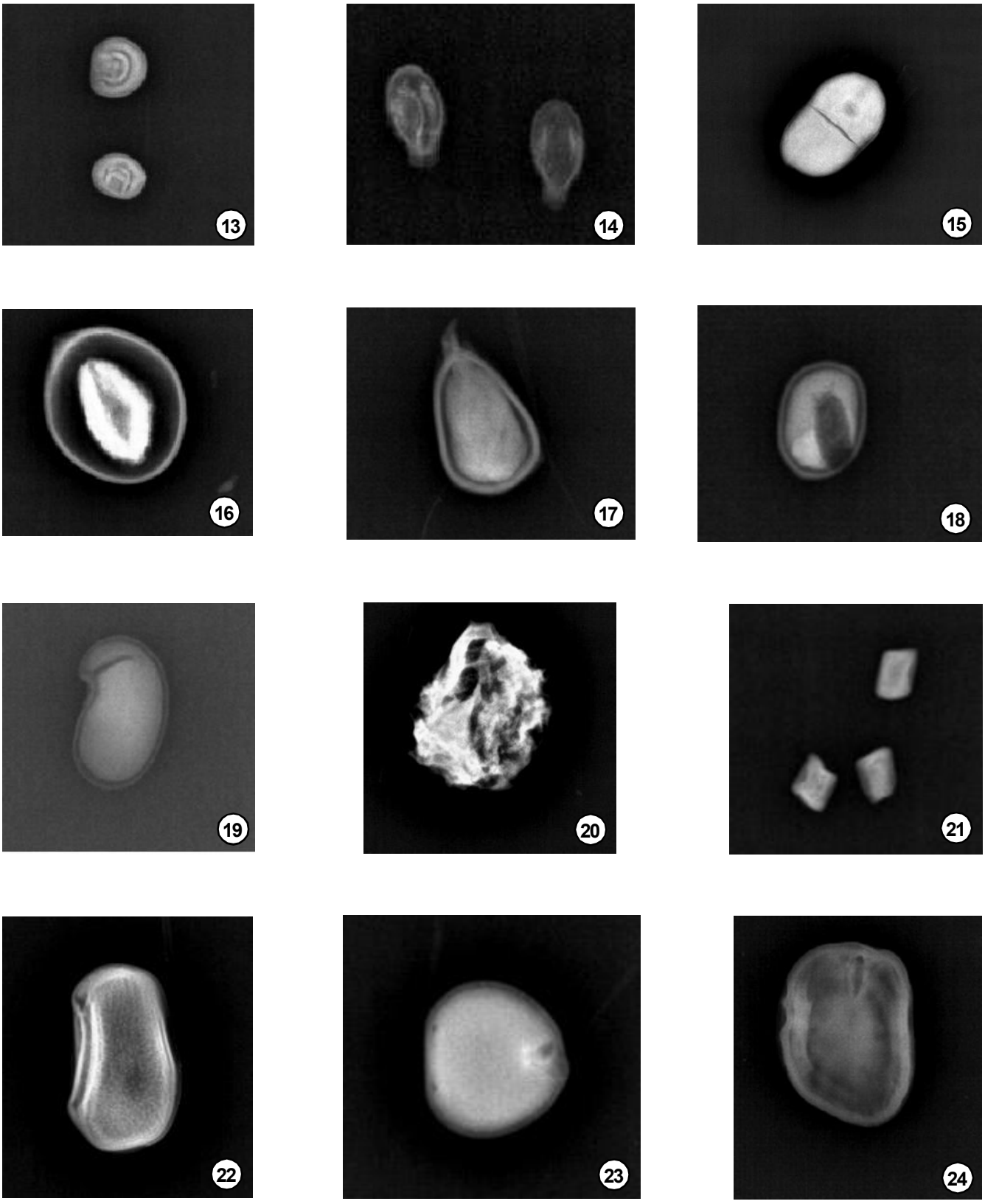

Fig. 1 B : Visualization of seeds after exposing soft X-rays [B: 13 to 24].
13 to 24 : where, **13** = *Datura innoxia*, **14** = *Diplocyclos palmatus*, **15** = *Ecucalyptus globules*, **16** = *Santalum album*, **17** = *Thespesia populnea*, **18** = *Holoptelea integrifolia*, **19** = *Dalbergia paniculata*, **20** = *Balanites aegyptica*, **21** = *Cassia tora*, **22** = *Sammania samman*, **23** = *Caesalpinia pulchirrima*, **24** = *Sterculia foetida*.

Table 1 : Standardized mean radiation doses for four groups of plants.

No.	Botanical group	Current (Standardized)		Type of seeds	Remarks
		kV	mAs		
1.	Trees	22	59	Healthy, viable seeds	Good contrast
2.	Shrubs	22	56	Healthy, viable seeds	Good contrast
3.	Herbs	20	52	Healthy, viable seeds	Good contrast
4.	Climbers	20	50	Healthy, viable seeds	Good contrast

Here, kV = Kilovolts, mAs = milli ampier seconds, both these unit describes peak tube potential in storage equipment.

percent empty seeds and percent filled seeds using X-ray radiography. According to ISTA (1996), X-ray provides high performance for seeds of any kind that is why this quality test has great importance. Mico *et al.* (1998) studied quality of seeds and found cause for bad germination using X-ray technique. Study on variation of internal structure of seeds was carried out in Southern Poland (Skrzyszewska and Chlanda, 2009). Studies in the field of seed X-rays are inspiring with Salazar (1986), Simak and Gustafsson (1954), Kamra (1972, 1976), Belcher (1974), Simak (1974, 1980) and Smirnova (1978).

It is concluded that, seed that is basic source of plant material whose quality plays very important role in germination, viability, storage, structure and function. These can be assessed using soft seed X-rays. Standardized lower doses of radiation advocates basic details regarding internal morphology. This evaluation account useful details for researchers in Seed Science, Physiology, Ecology and other branches of Plant Sciences.

Acknowledgement

Authors are thankful to Dr. Rajanpara (Head, Department of Radiology, Gujarat Cancer Research Institute, Ahmadabad, Gujarat) and supporting staff of radiology department including X-ray technicians, who helped us in the experiment all the time.

References

Belcher, E. W. (1974). Radiography in tree seed analysis has new twist. *Tree Planters Notes*, **24** : 1-5.

Huss, E. (1951). Skogsforskningsinstitutets metodik vid froundersokningar.-Medd. Stat. Skogsforskn.- Inst. Stockholm. Bd. 50.No. **6** : 1-82.

ISTA (1976). International rules for seed testing : Provisional rules for the excised embryo test. *Seed Science and Technology*, **4(1)** : 3-177.

ISTA (1996). *Seed Science and Technology*, **24(suppl.)**, 75.

Kamra, S. K. (1972). Comparative studies on germinability of *Pinus silvestris* and *Picea abies* seed by the indigo carmine and x-ray contrast methods. *Studia Forestalia Suecica*, **99** : 1–21.

Kamra, S. K. (1976). Use of X-ray radiography for studying seed quality in tropical forestry. *Studia Forestalia Suecica*, **131** : 1–34.

Mico, M., A. Labrada and S. Calderon (1998). Use of X-ray analysis in studies of quality of seeds of some species of agricultural and forestry interest. *Journal of Radiology and Nuclear Chemistry*, **240(2)** : 471-474.

Salazar, R. (1986). Seed and seedling provenance variation under greenhouse conditions of *Pinus caribaea* var. *hondurensis* Barr et Golf. IPEF, No. **32** : 25–32.

Simak, M. (1970). New use of X-ray method for the analysis of forest seed. IUFRO International of forest trees. Varparanta, Finland. pp. 11.

Simak, M. (1974). Vaporous X-ray contrast agents for testing seed viability of *Pinus silvestris* L. In: Proceedings: Seed X-ray Symposium. Macon, USA : 29–39.

Simak, M. and A. Gustafsson (1954). Seed properties in mother trees and grafts of Scots pine. Meddelanden från Statens *Skogs-forskningsinstitut*, **44** : 1–73.

Smirnova, N. G. (1978). Rentgenografièeskoje izuèenije siemjan listviennych dreviesnych rastenij. Moskva, Akademija Nauk SSSR, Izdatel'stvo Nauka: 243.