EFFECT OF COMBINATION METHODS ON INSECT DISINFESTATION AND QUALITY OF PLANT NUTS

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ABSTRACT

Almond, groundnut, pinenut and walnut, were radiated (0.25 kGy) after packing in coloured and clear polyethylene bags (0.04mm) and subsequently stored for 24 weeks at room (16– 36°C) and low temperatures (10– 20°C). The effect of these treatments on insect infestation and quality was studied. It was observed that radiation (0.25 kGy) treatment in combination with low temperature (10– 20°C) completely checked the insect infestation of nuts during 24 weeks of storage. Peroxidation was higher in samples stored at room than at low temperature. Storage period had a marked adverse influence on sensory quality of nuts, however, samples kept at low temperature were comparatively rated higher.

Keywords: Insect disinfestation Plant nuts Irradiation Quality Storage

I . INTRODUCTION

Dry fruits and nuts are considered a good source of income and foreign exchange in some countries of the world[1]. Nuts are a concentrated food and widely consumed by people of the northern area of Pakistan. Insect and microbial infestation and oxidative deterioration of stored nuts is a serious problem in several countries especially under humid tropical conditions[2]. The magnitude of storage losses varies with the postharvest storage practice. It has been estimated that these losses may vary between 15– 20% in Pakistan[3].

Fumigation as chemical disinfestation of dry fruits require repeated application because it may not eliminate the eggs of the insects. Moreover, there is a growing concern for chemical pesticides for their residual health problems. The use of gamma radiation for disinfestation of insects in fresh and dry fruits and nuts has been attempted by some workers[4-8]. However, conflicting results have been reported as to the insects involved and optimum radiation dose needed for disinfestation. Neither chemical pesticides nor irradiation treatment can prevent oxidative deterioration. Because of high contents of unsaturated fatty acids, some nuts are particularly susceptible to oxidative rancidity[9]. Present studies were undertaken to investigate the effects of radiation in combination with low (10– 20°C) and room temperature (16– 36°C) storage on insect infestation, lipid oxidation and sensory quality of some shelled nuts.

II . MATERIALS AND METHODS

Fresh samples of dry nuts such as almond, groundnut, walnut and pinenut were

purchased from the dry fruit market of Peshawar. They were shelled carefully enough to avoid breakage of kernels. The moisture content of the dry nuts ranged from 4.1– 5.7% (wet basis). They were sorted for uniform size and appearance. For insect disinfestation studies the samples were irradiated, after packaging in clear polyethylene bags (0.04 mm) at a dose of 0.25 kGy (1 kGy = 100 krad) in a $^{60}Co-\gamma$ irradiator having a capacity of 3.2×10^{14} Bq and dose rate of 8.80 kGy h^{-1} and a maximum/minimum ratio of 2.5. The treated and untreated samples were stored at 10°, 15°, 20°C and room temperature (16– 36°C). The influence of different storage temperatures and radiation treatments on selected quality characteristics of dry nuts was investigated.

The nuts were examined for the extent and nature of insect infestation according to Bland[10], while the insect damage was calculated following the method of Cogburn[11]. Chemical analyses for peroxide value were carried out in fresh and after 6, 12, 18 and 24 weeks of storage according to Lea[12]. Sensory evaluations were conducted by hedonic rating on a 9– point scale[13].

Ⅲ. RESULTS AND DISCUSSION

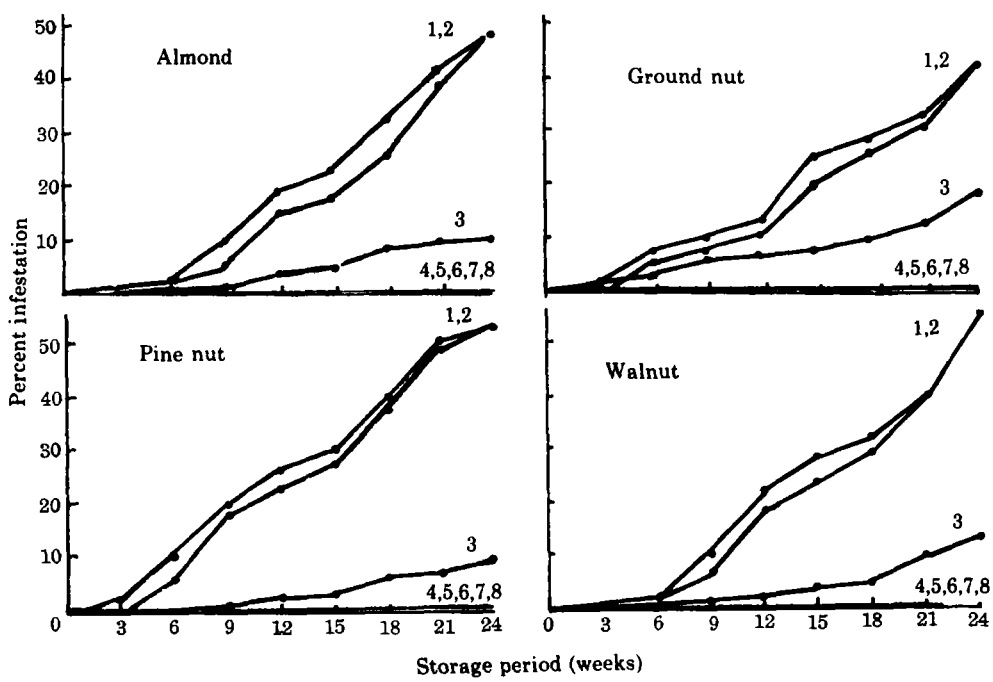

Fig.1 Effect of irradiation and storage temperatures on insect disinfestation of plant nuts

1. Unirradiated room temperature 2. Irradiated room temperature 3. Unirradiated 20°C 4. Irradiated 20°C 5. Unirradiated 15°C 6. Irradiated 15°C 7. Unirradiated 10°C 8. Irradiated 10°C

The combined effect of irradiation and storage temperature on insect disinfestation is shown in Fig.1. Initially all the samples were apparently free of any infestation,

which increased with advancing storage period specially at room temperature. Infestation was slightly higher in pinenut and walnut than almond and groundnut. There was no insect infestation in samples kept at 10°C and 15°C throughout the storage period. Slight infestation was observed at 20°C whereas almost 40– 60% infestation occurred in all the unirradiated dry nuts on 24 weeks storage at room temperature. Radiation treatment with 0.25 kGy alone was not effective in controlling insect infestation in dry nuts. However, irradiation (0.25 kGy) and subsequent storage at lower temperature (10 – 20°C) comletely checked the development of all types of insects during entire storage.

Identification of infesting insects indicated that Tribolium Castaneum was dominant insect affecting the pinenut and walnut; almond was mostly attacked by Cadra Cautella and groundnut by Polidia Interpunctella. It appears that soft texture of pinenut and walnut might be a reason of higher infestation as compared to the kernels of almond and groundnut which had hard texture and seed coat. Conflicting results have been reported in the literature for the control of dry fruit insects. Papodopoulou[14] recommended a dose of 1– 2 kGy for complete destruction of Plodia, Cadra and Oryzaephilus species during their various stages of development in dried figs. Beczner and Farkas[15] suggested that a radiation dose of 0.70 kGy was necessary for the control of Indian meal moth. Gonzales[16] reported that dose of 1.0 kGy was sufficient to suppress insect infestation in stored produce. However, Rovetti[17] and Brower and Tilton[5-6] recommended a dose of 0.40 kGy for insect control in dry fruits and nuts.

Peroxidation rate (*POV*) of dry nuts determined during a storage period of 24 weeks is presented in Table 1. It was observed that oxidation was higher in walnut and pinenut than almond and groundnut. Similar trend for insect infestation was observed in unirradiated control. The initial peroxide value ranged 2.1– 4.3 meq/kg in fresh nut sample which reached to 14.0 – 24.0 meq/kg (*CV* 48.5– 55.8%) in samples stored at room temperature. The peroxidation was quite low i.e. 5.6– 8.2 meq/kg at low temperature (10– 20°C). No prominent difference in peroxide development was observed during the early storage period of 6 weeks. During further storage the peroxidation was quite higher in samples stored at room temperature than at low temperature (10– 20°C). The mean *POV* of stored nuts was 5.1, 9.4, 11.5 and 13.4 meq/kg at 6, 12, 18 and 24 weeks with *CV* of 21.5, 67.5, 71.5 and 69.8% respectively indicating the obvious influence of storage period on lipid peroxidation. There is little information available on the development of oxidative rancidity of nuts during storage under humid tropical conditions. Sattar et al[8] observed that rate of peroxidation was higher in walnut and pinenut than other nuts which consistantly increased during further storage. Jan and Co– workers[3] reported that lipid oxidation progressed during storage in walnut but found no statistical difference between unirradiated and irradiated (0.5– 1.0 kGy)

Table 1

Effect of storage temperature on peroxide value (meq/kg) of dry nuts

Dry nut/Temperature	Storage period(weeks)				Mean	*CV.*
	6	12	18	24		
Almond – Room	3.8	13.6	18.8	22.7	14.8	55.8
10°C	3.7	5.7	6.5	8.1	6.0	30.5
15°C	3.7	5.8	6.5	8.2	6.1	30.8
20°C	3.7	5.8	6.9	8.5	6.2	32.4
Groundnut– Room	4.7	13.5	17.8	20.1	14.0	48.4
10°C	4.0	4.9	6.3	7.2	5.6	25.5
15°C	4.5	5.3	5.9	7.5	5.8	21.9
20°C	4.6	5.4	6.3	7.7	6.0	22.2
Pinonut– Room	6.8	25.0	30.5	33.5	24.0	49.9
10°C	6.1	7.4	8.5	9.5	7.9	18.6
15°C	6.2	7.6	8.6	9.5	8.0	17.7
20°C	6.3	7.7	8.9	9.9	8.2	18.9
Walnut – Room	6.0	23.3	29.6	35.5	23.6	54.0
10°C	5.7	6.2	7.2	8.3	6.9	16.8
15°C	5.7	6.3	7.5	8.9	7.1	19.9
20°C	5.6	6.6	7.9	9.5	7.4	22.8
Mean	5.1	9.4	11.5	13.4		
CV	21.5	67.5	71.5	69.8		

Room temperature: 16– 36°C Initial value: almond 2.1, ground nut 2.3, pinenut 4.3, walnut 3.1 meq/kg

CV. = Coefficient of variability (sample standard deviation expressed as a percentage of mean)

Table 2

Effect of storage temperature on sensory scores of dry nuts

Dry nut/Temperature	Storage time(weeks)					Mean	*CV.*
	0	6	12	18	24		
Almond – Room	7.8	6.0	6.0	5.0	4.7	5.9	20.5
10°C	7.8	6.5	6.9	5.6	5.0	6.4	17.2
15°C	7.9	6.5	6.8	5.4	4.8	6.3	19.4
20°C	7.8	6.0	6.5	5.0	4.6	6.0	21.2
Groundnut– Room	7.8	6.0	6.0	5.8	4.7	6.1	18.4
10°C	7.7	7.2	7.2	6.2	5.8	6.8	11.6
15°C	7.7	7.1	7.1	6.0	5.4	6.7	14.0
20°C	7.7	7.1	7.1	6.0	5.3	6.6	14.6
Pinenut– Room	7.0	5.0	5.0	4.7	3.5	5.0	25.0
10°C	7.1	6.5	6.5	5.1	4.3	5.9	19.6
15°C	7.0	6.2	6.2	5.0	4.2	5.7	19.4
20°C	7.1	6.2	6.2	5.0	4.1	5.7	20.5
Walnut – Room	7.5	5.0	5.0	4.1	3.3	5.0	31.7
10°C	7.0	5.9	5.9	4.8	4.5	5.7	21.2
15°C	7.5	5.4	5.4	4.7	4.1	5.4	23.7
20°C	7.6	5.4	5.4	4.6	4.0	5.4	25.3
Mean	7.5	6.1	6.2	5.2	4.5	–	–
CV.	4.1	11.3	11.8	11.4	14.8	–	–

Room temperature: 16– 36°C Values are the mean of 8 judgements for colour, taste and flavour

Scoring scale = 1– 9 (1– extremely disliked, 9– extremely liked)

samples. It was also suggested that shelled walnut should be packed in tin or laminate containers with nitrogen gas in order to prevent major deterioration of quality during storage at ambient temperature.

The effect of temperature and storage on the overall sensoric acceptability based on the scores for colour, texture and taste was also determined (Table 2). It was found that storage period had a marked damaging effect on the sensory quality scores. The decrease in mean scores was higher in dry nuts stored at room temperature than other treatments tested; however, comparatively higher scores were noticed for nuts kept at 10°C. Lower rating for the sensory scores of nut at room temperature were probably due to higher peroxidation. Wahid et al.[18] reported that organoleptic scores of dry fruits (apricot, raisin, date, fig) decreased with storage and the decrease was higher at room (16 – 36°C) than low temperature storage (10 – 20°C). Similarly Sattar et al. also reported higher damaging effect of storage on the acceptability scores of dry nuts. Jan et al.[3] reported that high temperature storage (40°C) drastically reduced the acceptability scores of shelled walnuts.

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