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A COMPARATIVE TAXONOMIC STUDY OF SEEDS OF SOME PLANTS OF ROSACEAE FAMILY IN IRAQ

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Abstract

Seeds of 12 types of fruits of plants within the family Rosaceae, representing seven genera cultivated in Iraq were examined. The study included *Pyrus communis* L., *Eriobotrya japonica* (Thunb.) Lindl., *Cydonia oblonga* Mill., *Crataegus azarulus* L., *Malus domestica* Borkh., *Prunus persica* (L.) Batsch., *Prunus persica* var. *nectarina* (Sol.) Maxim., *Prunus persica* var. *platycarpa* (Decne.) L.H. Bailey, *Prunus domestica* L., *Prunus domestica var. italica* (Borkh.) Schneid., *Prunus cerasus* L., *Prunus armaniaca* L. and *Rosa damascene* Mill. Seeds were glabrous except of *R. damascene* were pubescence. Seeds of *Prunus* were coated by brown thin dry cover (testa) and in other genera were near this color either reddish brown as of *M. domestica* or light brown as of *C. azarulus* or dark brown– black as of *E. japonica*. Most seeds were ovate or obovate but were elliptic in *P. armaniaca*, puffed Oblong in *E. japonica*, spherical in *P. persica var. platycarpa* and were hemi spherical in *C. azarulus*. Seeds of *Prunus* were covered by hard woody endocarp; each type has different color and surface sculptures. There were variations in the surface configurations of endocarps and seeds between genera; it can be used as taxonomic evidences in separating the nearest taxa.

***Keywords*:** Rosaceae, *Pyrus*, *Eriobotrya*, *Cydonia*, *Crataegus*, *Malus. Prunus, Rosa*

Introduction

Rosaceae is cosmopolitan, 115 genera and 3200 species, with economic importance especially in the tropical zones; known as fruits such as apples, peach, apricot or decoration plants such as roses (Al-Kateb, 1988). Plants of Rosaceae are trees, shrubs or herbs, flowers mostly actinomorphic, bisexual or rarely unisexual, fruit an achene, follicle, drupe or pome, rarely a capsule, seeds without or very scanty endosperm, (Tawsend *et al.,* 1966). Rosaceae family was re- classified into three subfamilies: Rosoideae, Dryadoideae and Spiraeoideae; all genera of Punoideae and Maloideae were included into Spiraeoideae, (D. Potter *et al.*, 2007). The last subfamily is rather to be called Amygdaloideae under the international Code of Nomenclature as updated in 2011 (McNeill *et al.,* 2012). The fruits of C. *oblonga* due to its hardness, acidity and astringency it is not edible fresh but it is often used to prepare jam, (Branca *et al.*, 2005). Hawthorn plant *C. azarulus* is commonest native species in Iraq the yellowish- red fruit eaten and the wood is durable, (Tawsend *et al.,* 1966). Plants of *E. japonica* cultivated mainly as an ornamental on a small scale in our gardens (Chakravarty, 1976), it is an exotic plant for Iraq, *E. japonica* used in food products and for health which were the leaves used for asthma, dyspepsia, bronchitis, kidney cases, and blood sugar control, (Ito *et al.*, 2000; Bagamboula, 2004). Roses have been cultivated for centuries and a number of varieties have been selected based on flower traits such as petal form, color, and number. Wild-type roses have five petals (simple flowers), whereas high numbers of petals (double flowers) are typical attributes of most of the cultivated roses (Annick Dobois *et al.,* 2010). *R. damascene* known as damask rose because it was originally brought to Europe from Damascus, it's an important species because of the essential oils its consisted (Mohamed *et al.,* 2014; Mahmoodreza *et al.,* 2010). Cultivated apple is a deciduous, rarely evergreen tree or shrub, differently from other Rosaceae species, it has a distinctive basic haploid chromosome number of x¼17 (Evans & Campbell, 2002). Apple flower is epigenous, bisexual and every flower has syncarpous gynoecium with ovary surrounded by non-ovarian tissue that will develop to form a pseudocarpic fruit, also called "false" or "pome" fruit (Rohrer *et al.,* 1991). Peach *Prunus* L. has high nutritive value as well as anti-allergic, antitumor, anticancer, anti- inflammatory, antibacterial and antimicrobial (Ravi Kant *et al.,* 2018). Monica *et al.,* 2015). (Al-Ma`thidy *et al.,* 2003). The study aimed to examine seeds of the most common fruit known between Iraqi people from the family Rosaceae, some of them edible and some are not (Table 1). Most researchers studied the chemical compounds and their medical important or their taxonomic aspects because there are so many synonyms, this study tried to found varieties in the morphological characteristics in seeds and endocarps particularly in the surface configurations and consider it as taxonomic evidence.

Table 1 : Classification and local name of studied species

Order	Family	Sub-family	Genus	Species	Common local names in IRAQ	Common foreign names
Ros-ales	Rosa-ceae	Amygdal-oideae	*Pyrus*	*communis*	Ārmot	Pear
			Eriobotrya	*japonica*	Yenk Denea	loquat
			Cydonia	*oblonga*	Safarjal, Haiwa	quince
			Crataegus	*azarulus*	Zārūr	hawthorn

			Malus	*domestica*	Tuffah	Apple
			Prunus	*persica*	Khoukh-sufy	wooly peach
				persica var. nectarina	Khoukh- amlas	smooth peach
				persica var. platycarpa	Khoukh- kaāky	flat peach
				domestica	Injās	European plum
				*domestica var. italica**	Gaucha	greengage
				cerasus	Karaz	cherry
				armaniaca	Mishmish	apricot
		Ros-oideae	*Rosa*	*damascena*	Ward	rose

Prunus domestica var. italica after flora of Iraq vol II 1966, but it is *Prunus domestica* subsp. *italica* (Borkh.) Gams, after plant list organization in 2012

Materials and Methods

The study followed (Al-Zubaedy *et al.,* 2013) method to examine 25 seeds were collected from well ripe fruits of Rosaceae plants cultivated in orchards and gardens in different districts in the north and east of Iraq during 2017. Some seeds were soaked with salty water to facilitate the breakage of their woody solid cover (endocarp).

Results and Discussion

(A) Quantitative characteristics: (Table 2) and (Table 3)

(i) *Pyrus communis*:

The fruit of pear was yellow or greenish yellow, endocarp was white; cartilaginous enclosed the locules of the mature ovaries were the seeds exited. Seed was elongated obovate, dark brown- black.Seed was glabrous and lack surface sculpturing, entire. (fig.1)

Fig. 1: Seeds of *Pyrus communis*

(ii) *Eriobotrya japonica*:

The endocarp was thin membranous, white, lining the fleshy mesocarp and merged with it. The seed was oblong, dark brown- black. Seed was glabrous and entire without any sculpturing. (fig.2)

seeds with testa seeds with broken testa seeds

Fig. 2: seeds of *Eriobotrya japonica*

(iii) *Cydonia oblonga*:

The fruit was pear shaped, yellow or yellowish green, endocarp was white cartilaginous, lining the fleshy mesocarp. Seed was dark brown- black, obovate with three faces (c.s. is triangular), the apex was not sharp acute but narrow semi-truncate. There was no sculpture on surface and seed was glabrous (Fig. 3).

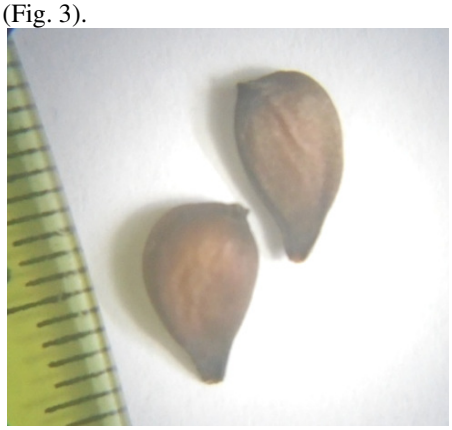


Fig. 3: Seeds of *Cydonia oblonga*
(1 mm. between black lines)

***Crataegus azarulus*:**

The endocarp was membranous immerged with the fleshy part of edible fruit (mesocarp and exocarp), fruit was yellowish- red. There were two seeds at the center of the fruit, each seed was elongated hemi- spherical; inner flat side and outer convex side; the inner sides face each other. The seed was light brown; with one longitudinal line elevated on convex side. Seed was glabrous. Surface configuration was simple muricate. (Fig. 4)

(a)two seeds attached together (5mm.)

(b)one seed half spherical (5mm.)

Figure 4: seed of *Crataegus azarulus*

***Malus domistica*:**

The study examined different types of apple; red, yellow, green and all of them have the same features. Endocarp was white, cartilaginous lining the fleshy mesocarp and including the seeds within the cavities of the locules in the mature ovaries (fruit). Seed was reddish- brown, glabrous, obovate with wide rounded apex and narrow base. Seed lack surface configuration so it is described as entire. (Fig. 5)

Green apple

Yellow apple

Red apple

Fig. 5: seed of *Malus domistica* (4mm. —)

(iv) *Prunus* L.

Texture of endocarp of fruit was hard- woody, almost ovate and consist one seed coated with brown thin testa, all seeds were glabrous and so were their woody endocarps, sometimes the seed inside it's woody endocarp called stony seed (Al- Ma`thidy *et al*., 2003) were seed cultivated and it's inside it. It was difficult to obtain good shape seed when tried to broken the woody endocarp. Qualitative characteristics will be as follow: (Fig. 6)

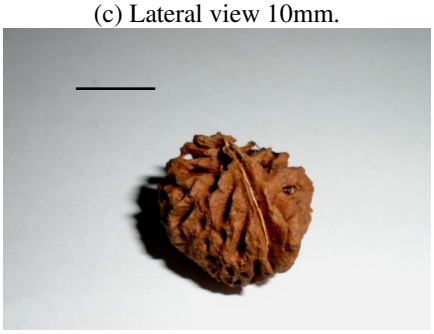
a. Fruit of *P. persica* was yellowish pink and wooly. Endocarp was lanceolate, golden light brown, irregular deep pits distribute on surface, deep elongated grooves near the base and there were small delicate pits near the sutures. Seed was brown, elongated ovate- lanceolate, glabrous; sculpturing was slightly raised elongated lines.
b. Fruit of *P. persica* var. *nectarina* was red and smooth. Endocarp was ovate- wide lanceolate, golden light brown, pits are deep, irregular and less, deep grooves and acute edges at the base. Seed was brown, elliptic, and glabrous; sculpturing was some slightly raised lines near both sides.
c. Fruit of *P. persica* var. *platycarpa* was red-pink, wooly; fruit is similar in shape with common wooly peach but with some flatness. Endocarp was spherical; dark reddish brown, deep elongated irregular pits sculpturing and acute grooves at the sutures. Seed was brown, wide ovate- spherical; sculpturing was dotted.

(a) Lateral view 10mm.

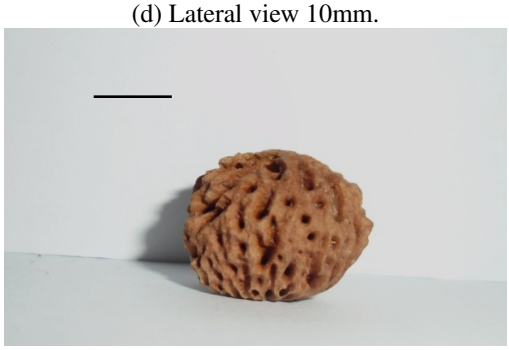
(b) Lateral view 10mm.

(c) Lateral view 10mm.

(d) Lateral view 10mm.



(e) Apical view 10mm.

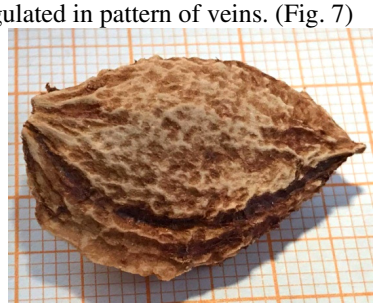


(f) Lateral view 10mm.

Fig. 6: Stony seed of *Prunus*: (a, b) *P. persica*, (c, d) *P. persica* var, *nectarina*, (e, f) *P. persica* var. *platycarpa*

d. Endocarp of *P. domistica* was whitish light brown, surface configuration is acute grooves at the edges, the pits are darker than the surface, deep edges are along the surface, clear grooves at the base. The seed was ovate, brown, acute apex; there were raised lines near the base regulated in pattern of veins. (Fig. 7)

e. Endocarp of *P. domistica* var. *italica* was whitish gray, wide ovate; surface smooth with some wavy- simple grooves clearly appear at the base. Seed was dark brown, elongated ovate- oblong, mucronate apex, surface was almost entire without sculpturing. (Fig. 7)



(a) Stony seed

(b) Seed

(c) Stony seed (10mm.)

(d) Seed

Fig. 7: seed of (a, b) *P. domistica,* (c, d) *P. domistica* var. *italica* (distance between colored lines is 1mm.)

f. Fruit of *P. cerasus* was red- reddish black. Endocarp was whitish gray, entire with some acute ridge near the suture. Seed was brown, ovate; apex acute, surface configuration is of simple protrusions give the appearance of reticulate shape or muricate. (Fig. 8)

(a) Stony seed

(b) Seed

Fig. 8: seed of *P. cerasus* (distance between lines is 1mm.)

g. Color of fruit of *P. armenica* was orange or yellowish orange. Endocarp was brown and it was light brown near base and ventral suture. Surface configuration is shallow reticulate, grooves and sharp edges appeared clearly at the suture. Seed is elliptic, brown, tapering at ends; surface configuration was simple lines raised near the base. (Fig. 9)

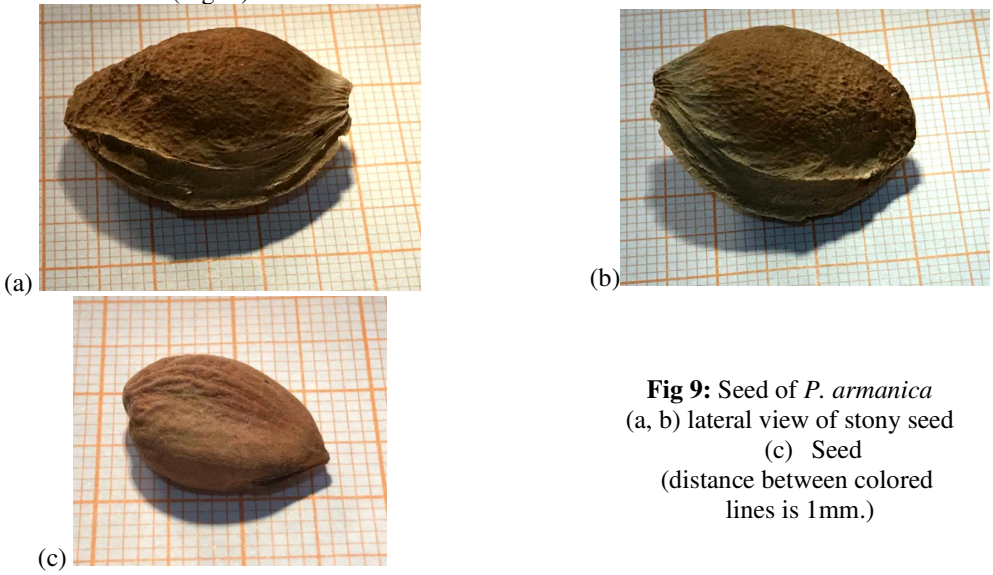
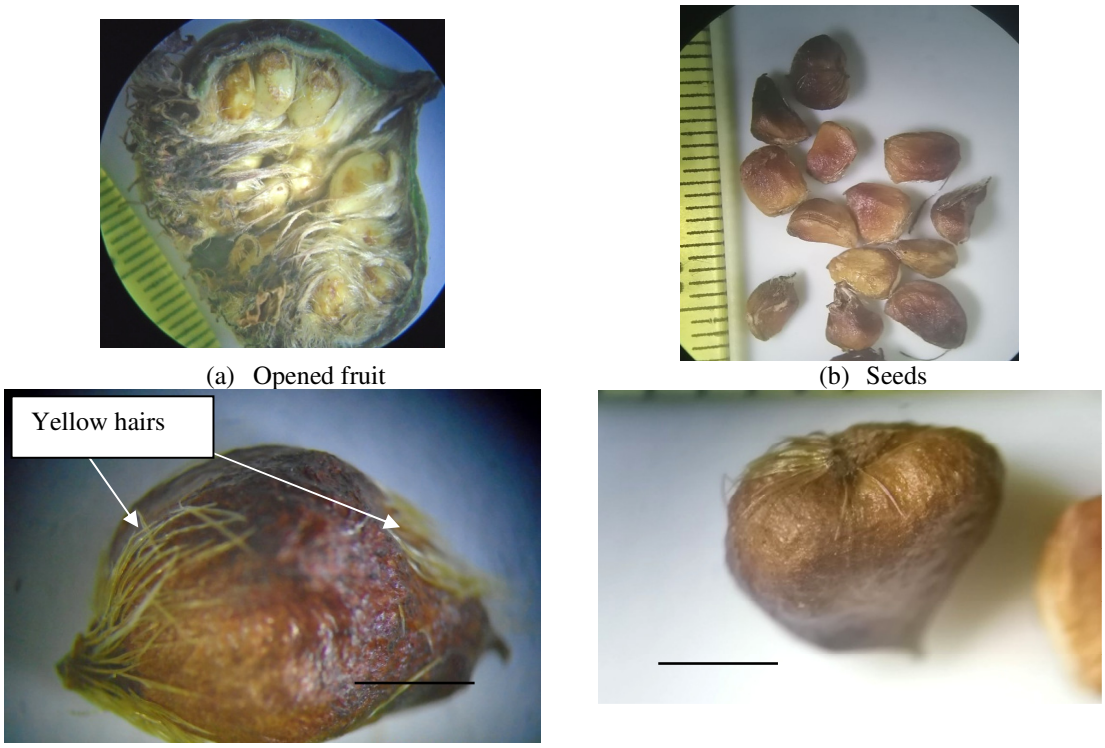


Fig 9: Seed of *P. armanica*
(a, b) lateral view of stony seed
(c) Seed
(distance between colored lines is 1mm.)

(v) *Rosa damascena*:

Fruit is aggregate, green or red or greenish pink. Gynoecium is poly- apocarpous enclosed within colored fleshy cup shaped receptacle, ovaries lined the inner wall of the receptacle and all styles upward; seed was brown, sometimes there were yellow color at the lower third part of the seed, irregular ovate or ovate with plane sides and the base was wide, there were simple yellow long hairs in different positions of the seed but in general the trichomes were near the base or near the apex. (Fig. 10)



(a) Opened fruit (b) Seeds

(c) Seed (scale 2mm.)

Fig. 10: seed of *Rosa damascena*

Table 2 : The morphological characteristics of seeds

Genus	Species	Morpholo-gical shape	Color	Surface configuration	Surface indumentums
Pyrus	*communis*	elongated obovate	dark brown-black	entire	glabrous
Eriobotrya	*japonica*	buffed oblong	dark brown-black	entire	glabrous
Cydonia	*oblonga*	obovate- pyramid	dark brown-black	entire	glabrous
Crataegus	*azarulus*	elongated hemi-spherical	light brown	irregular simple muricate	glabrous
Malus	*domestica*	obovate	reddish brown	entire	glabrous
Prunus	*persica*	elongated ovate-lanceolate	brown	slightly raised elongated lines	glabrous
	persica var. nectarina	elliptic	brown	slightly raised lines	glabrous
	persica var. platycarpa	wide ovate- spherical	brown	dotted	glabrous
	domestica	ovate	brown	raised lines	glabrous
	*domestica var. italica**	elongated ovate-oblong	brown	semi- entire	glabrous
	*cerasus***	ovate	brown	reticulate	glabrous
	armaniaca	elliptic	brown	raised lines	glabrous
Rosa	*damascena.*	irregular ovate	brown	delicate reticulate	pubescence

Table 3 : The morphological characteristics for endocarps

Genus	Species	Morphological shape	Color	Texture	Surface configuration
Pyrus	*communis*	linning mesocarp	white	cartilaginous	entire
	calleryana	elongated ovate	white	woody	entire
Eriobotrya	*japonica*	linning mesocarp	white	membranous	entire
Cydonia	*oblonga*	linning mesocarp	white	cartilaginous	entire
Crataegus	*azarulus*	elongated ovate	white	woody	muricate
Malus	*domestica*	linning mesocarp	white	cartilaginous	entire
Prunus	*persica*	wide ovate - lanceolate	golden light brown	woody	-irregular deep pits -deep elongated grooves at base -small delicate pits at suture
	persica var. nectarina	ovate	golden light brown	woody	-irregular deep pits -deep grooves & acute edges at the base
	persica var. platycarpa	spherical	dark reddish brown	woody	-deep elongated irregular pits - acute grooves at the edges
	domestica	ovate	whitish light brown	woody	-acute grooves at the edges - pits are darker - grooves at the base
	domestica var. italica	ovate	whitish gray	woody	smooth with some wavy- simple grooves at the base
	cerasus	ovate	whitish gray	woody	entire with some acute ridge at the suture
	armaniaca	wide ovate	brown	woody	-shallow reticulate - grooves & sharp edges at the suture
*Rosa**	*damascena*	-----	-----	-----	-----

**Rosa* has aggregate fruit

(A) Qualitative characteristics: (table 4)

The study measured length and width of each seed; it found that the largest seed was of *E. japonica* (15 - 17) mm. x (10- 14) mm. and of *P. armaniaca* (15 – 17.5) mm. x (±9 mm.); while the smallest was the seed of *R. damascena*. (±4 mm.) x (±3 mm.). Seed of *P. communis* has similar measurement with *C. oblonga* even they are from two different genera it was (±9 x ±4) mm. and (±9 x ±5)mm. respectively. All samples of studied seeds of *C. azarulus* have the same length (±8 mm.) but the width was varied (5-7) mm., The study observed seeds of three types of apple; red, green and yellow, they have the same length and width, so that we listed only one data for apple. Seed of *Malus domistica* was (5- 7) mm, x ± 5 mm. Seed of *P. persica var.*

platycarpa was smallest than seed of *P. persica* and *P. persica var. nectarine*, it was ±8 mm. x (5.5- 7) mm.; while the previous two taxa were (13- 17) mm. x ±14 mm. and (14- 16) mm. x ±9 mm. respectively. Seed of *P. domestica* was larger than *P. domestica var. italica*, the former was (14- 16) mm. x ±10 mm. while the previous was (10- 11) mm. x (6- 8) mm. Seed of *Prunus cerasu*s was the smallest seed between the studied species of *Prunus* L.; it was ±7 mm. x ± 5 mm., while *P. armaniaca* was the largest as mentioned before.

Table 4 : Length and width of seeds

Genus	Species	Without endocarp		With endocarp	
		L. (mm.)	W. (mm.)	L. (mm)	W. (mm)
Pyrus	*communis*	±9	±4	---	---
Eriobotrya	*japonica*	15- 17	10- 14	---	---
Cydonia	*oblonga*	±9	±5	---	---
Crataegus	*azarulus*	±8	5- 7	---	---
Malus	*domestica*	5- 7	±5	---	---
Prunus	*persica*	13- 17	±14	30- 36	24
	persica var. nectarina	14- 16	±9	30- 35	20
	persica var. platycarpa	± 8	5.5- 7	18-20 (diameter)	
	domestica	14- 16	±10	±32	±15
	domestica var. italica	10- 11	6- 8	10- 13	13- 15
	Cerasus	±7	±5		
	armaniaca	15- 17.5	±9		
Rosa	*damascene*	±4	±3	---	---

(----): endocarp is not distinguish

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