Anatomical Pollen Study of Some Species Dicots Spp. grown in Al-Najaf governorate

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Abstract

This study investigated the Anatomical properties on some cultivated Dicots species belongs Apiaceae, Solanaceae and Malvaceae Family, Ap. graveolens,D. carota, P. crispum, F. vulgare, C. sativum, S. melongena and Ab. Esculentus. Growen in Al -Najaf governorate, the anatomical characteristics such as the length of the polar axis, the equatorial axis, and the percentage of between the the two axes have been studied a and determine the length of the groove and width, thickness of pollen Exine, and the type of ornamentation of wall, the species has been studied using light microscope and Scanning electron microscope and show the presence difference between the length (162 – 14.2) um, (121 – 12.3) um of polar axis and equatorial axis respectively, it was presence through the study that the species belog to the Apiaceae have aprorate – spheroidal while a oblate – spheroidal of the solanaeae Family species, on the other hand sphiodal – sub spheroidal on the Ab.esculentus and measured the wall thickness and it was found that Ab. esculentus larger from other species and determine that the pores and grooves was tricolporate and rarely tetracolporate excepte the Ab. esculentus was penta to polyporate and studied the spines (echinae) on the surface of pollen grians of Ab. esculentus and cosidered an important taxonomic characteristic and spreads randomly on the surface of the grain, the type of tectum was faint in Ab. graveolens, D. carota and P. crispum, F. vulgare, C. Sativum and An.graveolens was simple faint in S. lycopersicum and was psilate (smooth) in S. melongena and, While was reticulate in C. annum on equatorial view, and echinate gemmate in Ab. esculentus in polar and equatorial view, on the other hands the ornamentation was granulate in D. carota, F. vulgare, C. sativum and S. melongena, exine was simple scabrate in An. graveolens and was scabrate in the C. annum and P. crispum and was smooth in Ap. graveolens,and simple faint in S.lycopersicum on the polar view and was divided according the size to small, medium – small,and very large. further C. annum was Tricolporate and rarely tetracoporate while the F. vulgare and C.sativum was Tricolporate and Tetracolporate while S. lycopersicum was tetracolporate and dependes on the number considered monad in all species except for the species S. melongena mostly tetrad.

Introduction

Man will continue to follow plants, admire them, describe them, and name them until the last days of his life At some point in the depths of history, a person somewhere picked up a plant and personified it That it was edible at that very moment a science was born later known as taxonomy Taxonomy is a term derived from the Greek language and means the law of order Although the process of evolution does not leave plants in a state of stability and stability However, taxonomy still aspires to reach its highest goal, which is to establish plants The world is in a comprehensive classification table, so it is necessary for the science of taxonomy to seek the assistance of various branches Botany, including morphology, anatomy, and ecology, Pollen grains are dispersed by many plants daily and form a major bulk of dust like particles air- borne. Each plant produces millions of pollen grains which has a unique shape and size for that plant and is used to identify the particular plant. These particles are blown by the air, carried by insects and every moving object, The pollen grains so dispersed can be collected and studied to know the type of plant it belongs to and ascertain its origin based on a plant profile done of particular regions. pollen is an indispensable part of the life cycle of flowering plants and represents the male gametophytic generation of seed plants and is source and transport unit for the male gametes. the study of pollen grain biology has relevance in agriculture, plant breeding, paleobotany and biotechnology, pollen grain have potential use in monitoring cytotoxic, gene transfer, effect of biochemical such as herbicides, pesticides and pollutants, understanding the organization and function cytoskeleton and association proteins, studies on expression and cloning of gene and researches on intracellular differentiatin and polarity [1] Pollen grains from honey give us important information about the region from where the pollen grain has been collected by the bees and pinpoint the most probable origin of honey.The study of Grain Pollen is one of the important factors in identifying and linking The evolutionary and natural relationships between different genera and plant families, and their value lies in the Classification of pollen grains in several important characteristics such as grain size, grain shape, type Surface decoration, the presence and preparation of holes and grooves in a single grain Pollen science is the science that studies everything related to pollen It contains spores in terms of its external appearance and internal structure, The value of pollen grains as a tool for reconstruction of the past vegetation and environment, and its applications in archaeology, geology, honey analysis, archaeobotany and forensic science is now widely known [2]. Pollen grains are valuable indicators of environmental conditions in the past and can be used in reconstruction the past flora and plant populations,Pollen is essential for sexual reproduction of flowering plants and plants that produce cones. Each pollen grain contains male gametes necessary for fertilisation. The scientific study of living and fossilised pollen grains is known as palynology. The male part of flowering plants is the stamen. This consists of an anther supported by a single stalk, the filament. The anther

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usually contains four pollen sacs which are responsible for producing pollen grains. Each pollen grain is a single cell containing two male gametes. Once mature, the anther splits open and pollen is released. Both male gametes are involved in fertilisation, resulting in formation of a zygote and an endosperm. This process of double fertilisation is unique to flowering plants. The taxonomic studies are important because they help in identifying and Knowledge of wild plant species, as well as the cultivated ones, especially those plants that are economic and be an important part of the wealth The nature of each country. Therefore, the diagnosis of plants and their study of their environment and areas of spread helps to Develop accurate scientific plans for the development of plant wealth in order to serve the economy of any country Thus, researchers and those interested in the field of classification have paid great attention By studying the anatomical, cellular and chemical characteristics and the characteristics of pollen grains Appearance traits, which help in determining the taxonomic position of any taxonomic rank Palenology is closely related to various sciences, including taxonomy and phylogeny Fossils and others. This science studies everything related to pollen grains in terms of: shape, size, type of decoration, presence and loss of holes and grooves And other subtle phenotypic characteristics belong to the pollen grain and the various plants that help in isolation. And the diagnosis of the plant type. It has benefited from these qualities in solving many problems,The classification that confronts researchers or specialists in this field, as the relationship of this science has been strengthened Classification through two directions The first is morphological, which is concerned with the study of shape, size, and structure. The second: it is geological, and as a result, the walls of the pollen grains are resistant to atmospheric and terrestrial factors, [3] The different pollen patterns made it gain great importance for its classification, and the difference usually appears Pollen science is the science that studies everything related to pollen It contains spores in terms of its external appearance and internal structure Either pollen grains are defined as spherical particles, usually with a resistant outer wall For decomposition it contains a substance (Sporopollenin) referred to as pollination. Self-pollination occurs when pollen grains are transferred from anther to stigma on the same flower, or an adjacent flower on the same plant. Cross-pollination occurs when pollen grains are deposited on stigma of a different plant of the same species. Flowering plants and gymnosperms rely on external agents or vectors for dispersal of pollen.

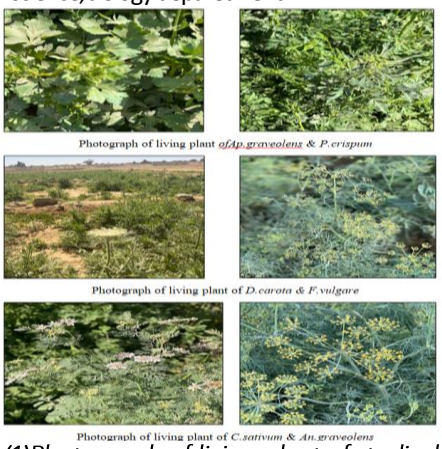
Material &Methods

preparing of pollen grains in Light microscopy (LM)

The pollen was isolated from fresh specimens by removing either whole parts of inflorescences or, individual flowers. Subsequently, the samples were shaken in the water,The pollen of the species under study was studied using fresh samples collected from various locations throughout regions from the province of Al- Najaf and followed the method of [4] for its preparation, take Anther unopened ripe flowers and put a whole flower on a slide We added it and opened with two dissection needles, then I moved the anther to another glass slide and opened it inside drop of safranin –Jelly gleserine, and then the excess parts of the anthers were removed, And then gently put the slide cover, and thus became ready for examination, as it was studied by Olympus optical microscopy, where (10-30) pollen grains of each type were measured by the using the ocular micrometer The slides were photographed using a digital camera USA (digital camera), Installed on the microscope mounted under the objective lens at a magnification of (40X) To take pollen measurements. Measure the polar axis and the equatorial axis view, Number of germination pore and grooves, germination pore diameter, External wall thickness, Pollen surface sculpturing type as photographed by the camera on this Microscope.

Preparing of pollen grains in Scanning electron microscopy (SEM)

Approximately 15~20 anthers and/or pistils with pollen grains on the stigma were collected from numerous plants Fresh pollen samples collected from those species were used for both quantitative and qualitative data during the study. Sample size for the statistical analysis ranged from 50 to over 250 depending on the amount, condition, and availability of materials. An effort was made to take measurements from mature structures, and washed three times in water, A dissecting microscope was used to prepare the slides then The samples were mounted directly on stubs using double sided adhesive tape and coated with gold/palladium in a sputter coater (Emitech K550X; Emitech Ltd.England), The Samples were examined with SEM (Republuic,Holand) in Kufa university, collage of science,biology deparetment.



Figure(1)Photograph of living plant of studied species flowers

Photograph of living plant *of C. cannum & S.melanogena*

Figure(2)Photograph of living plant of studied species flowers

Figuer(3): The Equipments that are used in the study, sputter coater and scaning electron micros.

Table (1) Quantitative data for the pollen of species.							
Exine thickness (µm)	Colpi		No. of Colpi	P/E ratio	Equatorial diameter(µm)	Polar axis (µm)	Species name
	Width(µm)	Length (µm)					
3.2(3.5)3.7	)21.71(	2.3(2.5)2.6	3	1.1	17.5(18)19.3	20.5(21)22.5	*Ap.graveolens*
2.69) .(1.21	2.) 3.82(2	1.2(1.9)2.6	3	1.1	17.2(18.6)19.4	20(22.3)23.6	*D.carota*
32.1 (2)	4.51)3.7(.2	2.6(4.1)4.8	3	1.1	11.7(12.5)13.2	13.2(14.4)14.8	*P. crispum*
.4(2.1)31	5.2) 32.1(	3.1)2.52(	3	1.1	11.8(12.8)13.6	14.2(14.2)17.5	*F.vulgare*
2.7)2.11 (	3.211(2)	6.56(5) .3	3	1.1	10.3(12.3)14.7	11.6(14.5)16.7	*C.sativum*
22.9)3.3(2	5.8)21.2(1.	.62) 22.2(	3	1.1	12.7(13.4)14.2	14.2(15.6)16.4	*An.graveolens*
1.2(2.7)5.4	.71(2)2	4.4(5.3)5.7	3	0.8	24.7(26.5)28.3	17.3(22.4)24.8	*C.annum*
2.6).61(1	.7)2 .31(2	46.8(5).2	3	0.8	18.2(21)23.9	15.8(17.2)19.9	*S. lycopersicum*
7.) 2.21(2	.61(2)2	5.75(5).2	3	0.8	15.5(18.8)21.9	17.1(19.3)21.8	*S.melongena*
2.3(5)6.4	55.8) .1(4.4	.3(5.5)5.84	5-12	1.3	112(121)126	154(162)170	*A.esculentus*

Table(2) Qualitative characters for the pollen of species				
Species name	Pollen Size	Pollen Shapes	Pollen type	Pollen description
Ap.graveolens	small	trilobate, circular	Tricolporate	Small Pollen grains monad elongate with rounded poles in equatorial view, trilobate, circular in polar view, tricolporate, colpi slim and almost extending to poles, sculpture faint in equatorial view and psilate in polar view
D.carota	small	obtuse triangular Convex	Tricolporate	Small pollen grain monad tricolporate colpus endoaperture lalongate outline in eqauatorial view surface faint in equatorial view and in polar view granulate, Colpus was long, narrow, sunken and lobed at mesocolpicum.
P.crispum	small	obtuse triangular Convex	Tricolporate	Small pollen grain monade tricolporate view surface faint in equatorial view and in polar view was scabrate
F.vulgare	small	obtuse triangular Convex	Tricolporate,tetracolporate	Small pollen grain monad tricolporate simple faint in equatorial and granulate in polar view.
C.sativum	small	obtuse triangular Convex	Tricolporate,tetracolporate	Monad,Pollen grains triangular, sub-angular in equatorial view, obtuse triangular in polar view, tricolporate, tetracolporate colpi slim and long, almost extending to poles, pores ellipsoidal with exine protruding around pore, sculpture simple faint Rod shaped, elongated,and in polar view granulate.

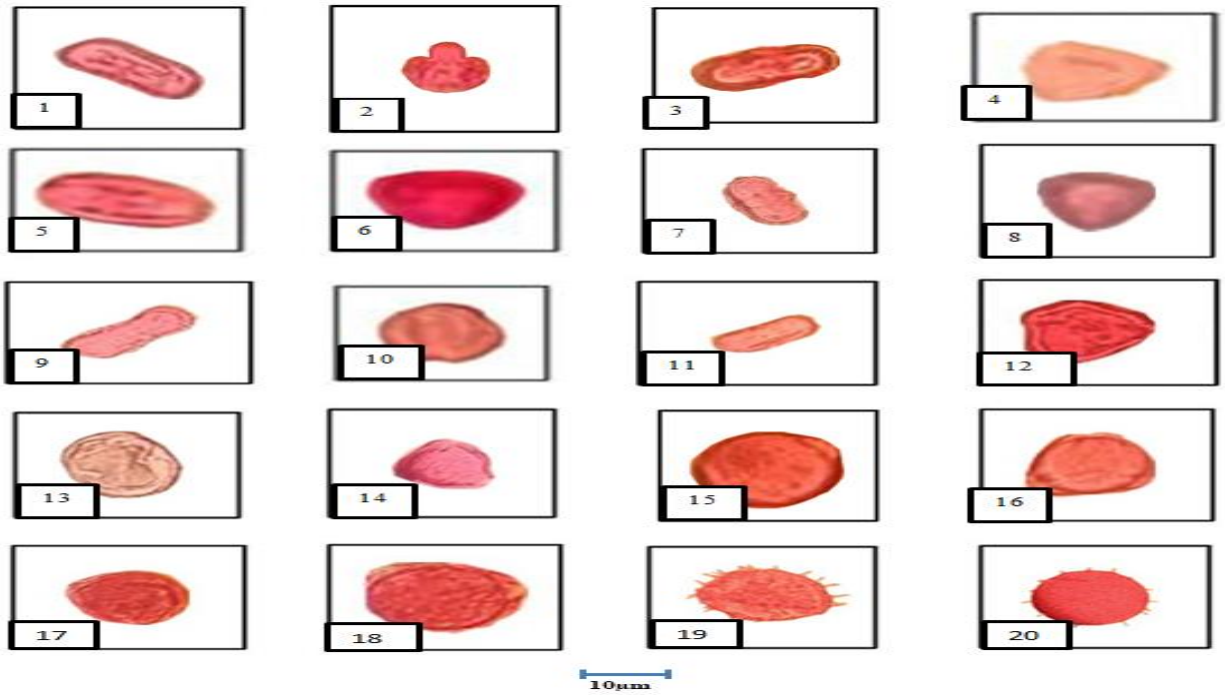


Plate (1): micrograph of the pollen of the studied species 1,3,5,7,9,11,13,15,17,19, equaterial view. 2,4,6,8,10,12,14,16,18,20 pollar view: 1&2 Ap.graveolens, 3&4 D.carota, 5&6 P.crispum, 7&8 F.vulgare, 9&10 C.sativum, 11&12 Ap.graveolens, 13&14 C.annum, 15&16 S.lycopersicum, 17&18 S.melongena, 19&20 A.esculentus.

Discussion

The morphology of pollen grain is one of the important tools in solving some taxonomic problems such as identification tracing phylogenetic relationship on the family, generic or

specific level and in plant systematic and evolution [5] The value of pollen grains as a tool for reconstruction of the past vegetation and environment, and its applications in archaeology,, archaeobotany and forensic science is now widely known [2]. Pollen grains are valuable indicators of environmental conditions and can be used in reconstruction the past flora and plant populations. Morphology and ultrastructure of pollen grain were described for ten species of Apiaceae,Solanaceae and Malvaceae family using light microscopy and scanning electron microscopy, The pollen grains characters of species are given in table(16) for the first time,the studied cultivars Pollen grains are tricolporate and rarly tetracolporate the germinal furrow extending almost the half length of the grain axis, Pollen size is useful as a taxonomic characteristic (5.5 -1.9)µm in length between *A.esculentus and D.carota*,and about(4.8-1.7)µm in width between *A.esculentus and Ap.graveolens*,The pollen grains of the cultivars studied exhibited significant differences between the cultivars with their polar and equatorial diameters (Table 16), which ranged from 162 to 14.2between *A.esculentus* and *F.vulgare* and from 121 to 12.3 between *A.esculentus* and *C.sativum* respectively(Prag etal,2008). In the analysis of the mean P and E values, the largest grains were found in *A.esculentus* (121)µm, and the smallest P values (12.3) µm i*n C.sativum*, and smallest E values (14.2)µm in *F.vulgare*, the apiaceae species has prolate-spheroidal pollen grains,while the solanaceae species has oblate-spheriodal and the shape was spheriodal to sub-spheriodal in *A.esculentus*,table (17) the thickness of the pollen grain varied significantly among the cultivars, For each pollen grain, the thickness of the exine layer was variable about 5 to 1.6 in *A. esculentus* and *S.lycopersicum* respectivelly. The apertures of pollen grains were observed as tricolporate most of pollen grains and rarely tetracolporate**,** Spines (echinae) Pollen grains of the *A.eschulentus* are characterized by having spiny tecta,(*Judd, 1997*). shape and surface distribution, These variations are considered as taxonomic value at different taxonomic levels [6], Spines are always evenly distributed over the surface of the grain and vary in their length, the distance between two neighbouring spines it is relatively large (10-15)µm plate(3-41a)Columellae in *A.esculentus* are always similar, rodshaped or with a broad lower part,the length of spines about (8.2-15.5)µm Variation in pollen size, aperture and spine characteristics, as well as exine stratification and ornamentation are all of taxonomic value, sculpturing of the pollen exine is useful for ascertaining relationships among species [7]. The exine ornamentation of pollen grains of studied species was classifiable to many types they was faint in *Ap.graveolens*(D), *D. Carota*(M), *P. crispum* (B)and *An.graveolens*(U)and was simple faint, *F.vulgare*(A), *C.sativum* (R), and S.lycopersicum(L) while was psilate in *S.melongena* (K),while was reticulate in *C.annum*(t) (*PERVEEN A & QAISER 2007*) in equatorial view and was echinate finally gemmate in both equatorial and polar view in *A.eschulentus*(Q,V,a), (*Hcssc, 2020*),on the other hand the exine ornamentation was psilate in *Ap.graveolens*(E) while was granulate in *D.carota(N),F.vulgare*(H), *C.sativum*(F) and S.*melogena*(w) and was scabrate in *P.crispum* (J)and *C.annum*(G)plate(3-39,3-41b) while simple scabrate in *An. graveolens(Y),* while was simple faint in *S.lycopersicum* in polar view, The pollen morphologies of the species have taxonomic significance observed variation mainly in pollen shape, *Ap.graveolens* have tricolporate pollen type, trilobiate circular pollen shape while obtuse triangular convex shape,tricolporate type trilobiate circular in *Ap.graveolens*, and was tricolporate obtuse traingular convex in*D.carota*,*P.crispum* and rarely tetracolporate in *C.annum*,with sub spheriodaland rectangular and elliptic shaped, pantaporate to polyporate in *A.esculentus* spherical ellipsiodal,while was tricolporateand tetracolporate obtuse traingular convex in *F.vulgare* and *C.sativum*,further more tricolporate,triangular in *An.graveolens*, visible tetrad pollen grain in *S.melongena* tricolporate, trilobate circular, while observed in S.lycopersicum pollen was tetracolporate, tetralobiate shape (*El-Ghazaly, 1990*) pollen grain dispersal form was monad in all studied species but mostely tetrad in *S.melongena*.

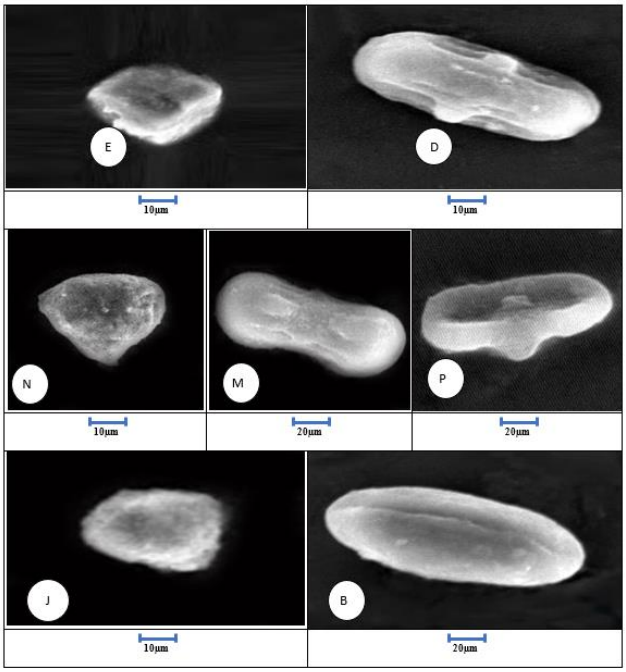


Plate (2) scaning electron microscope photomicrograph of pollen grain for studied species, Pv=polar view,Ev=equatorialview,E&D *Ap.graveolens*, Pv&Ev; N&M&P,*D.carota*, Pv&Ev;J&B,*P.crispum*, Pv&Ev; p=mesocolpium

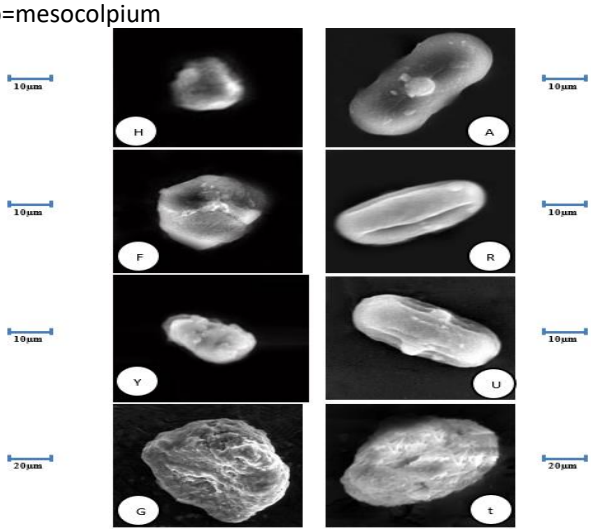
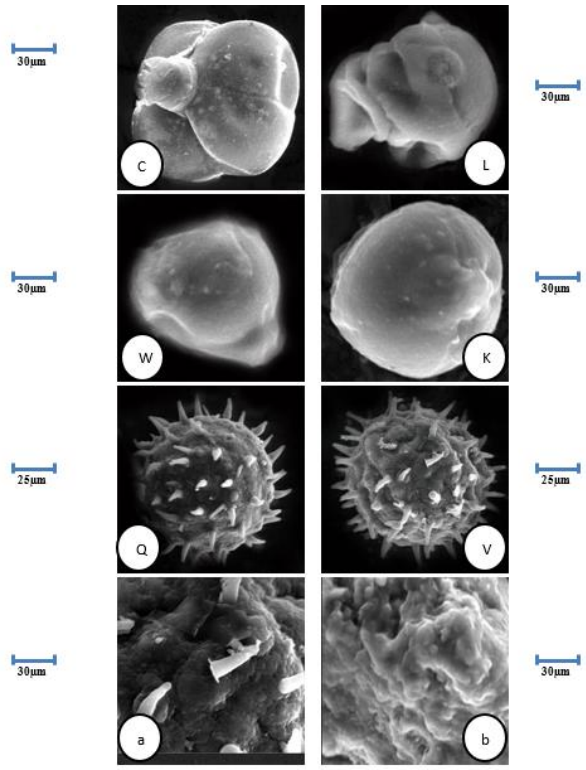


Plate (3)Scaning electron microscope photomicrograph of pollen grain for studied species, Pv= polar view, Ev= equatorial view,ES,exine sculptuer;H&A,*F.vulgare*, Pv&Ev;F&R,*C.sativum*, Pv&Ev; Y&U, *An. graveolens*, Pv&Ev; G&t*, C.annum*, Pv&Ev.



Plate(4)Scaning electron microscope photomicrograph of pollen grain for studied species, Pv= polar view, Ev= equatorial view,ES,exine sculptuer; C&L,*S.lycopersicum*, Pv&Ev lateral; W&k,*S.melongena*, Pv&Ev; Q&V,*A esculentus*, Pv&Ev; a,spine of *A.esculentus*, b, exine ornamintation of *C. annum* a,exine ornamintation of *A.esculentus*.

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