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Edible and Medicinal Plants Sold at Selected Local Markets in Batu Pahat, Johor, Malaysia

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Abstract. The market is the main place for transactions of medicinal plants and traditional ingredients by the local community in the district of Batu Pahat, Johor, Malaysia. This is the first study to document the local knowledge of local sellers and to survey the diversity of edible and medicinal plants sold at the local markets. The investigation was carried out in seven selected local markets of Batu Pahat. The study was conducted through ethnobotanical approach using market surveys. A total of 50 respondents were interviewed using semi-structured interviews. Data were analyzed qualitatively using descriptive analysis. This study recorded 120 species, 93 genera, and 49 families of medicinal plants. Those that were sold mostly belong to Zingiberaceae (12 species), followed by Rutaceae and Lamiaceae respectively (eight species) and the species received high consumers demand, mostly belong to Zingiberaceae and Rutaceae. The study revealed the local knowledge, diversity, and utilization of medicinal plants, which have been traded in Batu Pahat local markets, act as a basis for conservation efforts.

Keywords: documentation, ethnobotany, Johor, local markets, plant diversity

INTRODUCTION

Local market or traditional market is a type of open-air market, a term which could be defined as having permanent or temporary structures and may operate daily or only one-day a week [1]. In general, local markets around the world are considered as important places for plant resource and trading among local people. They also play a social role of exchanging traditional use of herbal medicine among different cultural and social groups at local level [2]. Market survey is often engaged in ethnobotanical studies for documenting locally used herbal plants and their associated traditional knowledge. Local markets, commonly known as *Pasar Pagi* or *Pasar Malam*, have been around for decades in Malaysia and frequently visited by the locals all over the country. Some local markets in Malaysia, including in the area of Batu Pahat, Johor are the main sources to acquire medicinal plants to be used as an ingredient in traditional medicine or simply for preparing cuisines. Despite their importance, however, no single studies about ethnobotanical investigations on local markets have been reported for Peninsular Malaysia except in Sabah [3] as compared to other regions of biodiversity hotspots such as Indonesia [4, 5] and Brazil [6, 7], which are more progressive.

Malaysia is ranked as the twelfth megadiverse country in the world based on its richness and endemism of flora and fauna. Peninsular Malaysia is estimated to have more than 2 000 species of medicinal plants and about 800 plant species are being used by different ethnic groups all around the country [8]. Unfortunately, rising demand for medicinal plants has led to increased pressure, especially on wild plant populations. As a consequence, the plants are

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over-harvested from the wild and perhaps sold illegally in the markets due to less control and poor monitoring [9]. Therefore, an initial survey at the local markets should be initiated to facilitate the monitoring. The objectives of the study were: (i) to document traditional knowledge of the use of these plants among the traders in Batu Pahat local markets and (ii) to assess the diversity of edible and medicinal plants sold in Batu Pahat local markets.

MATERIALS AND METHODS

Study Areas

The area of study focused on local markets within Batu Pahat district. The capital of the district is Bandar Penggaram, Batu Pahat, and situated at 1°51′N, 102°56′E in the state of Johor in southern Peninsular Malaysia. It is located 239 km to the south of Kuala Lumpur. The whole district of Batu Pahat has a population of about 468 058 local residents. As for the racial demography, the Malays make up the majority of the population at 54 % followed by the Chinese at 43 % and Indians at 2 % [10]. The study areas include Senggarang, Rengit, Parit Raja, Tongkang Pecah, and Batu Pahat.

Interviews and Data Collection

A total of 50 respondents, who are among the local plant traders from the selected local markets and nearby nurseries, were interviewed in this study. Information on the uses and the diversity of medicinal plants traded in the seven local markets were obtained through semi-structured interviews. The interviews consisted of a short conversational prelude in which the background of the research was explained and prior informed consent was obtained, before proceeding with data collection. Personal data of the informant was gathered at the end of each session. Recording techniques included the uses of digital record, free-listing, and photography. Information collected included the local names of the plants, their uses, parts used, methods of preparation, ways of administration, places of supply, and information on whether cultivated or from wild habitats.

Plant Samples and Identification

For each market survey, samples of medicinal plants mentioned during the free-lists were purchased from or contributed by the sellers for voucher specimens and scientific identification. The plants were then identified using the standard plant identification references [11, 12]. Scientific names of the plant species were verified using standard online sources (e.g., The Plantlist).

Data Analysis

The data were analyzed qualitatively. Qualitative data included species of edible and medicinal plants, health benefits, organs harvested, supply, and resource acquisition. The data were analyzed using qualitative descriptive statistical methods. To complete the analysis, secondary data were obtained from other available publications of other researchers.

RESULTS AND DISCUSSION

Background and Characteristics of Medicinal Plants Traders in Local Market of Batu Pahat

The local traders were dominated by women with 29 females and 21 males, ages ranging between 20 years old to 70 years old. Most of them were from Javanese-Malay ethnic. The traders were divided into three classes which are medicinal plants seller, vegetable seller, and also several medicinal plants seller from selected nurseries. Most of the traders have been working as the seller for more than two years. Since the traders of medicinal plants in

Batu Pahat local markets were mostly from Javanese-Malay ethnicity, the local names of medicinal plants are highly similar. In the traditional culture of Javanese-Malay ethnicity, women are responsible for maintaining family health, whereas men are responsible for the fulfillment of basic needs. Therefore, women are more knowledgeable and able to identify medicinal plants better than man. This is due to the advantages of trading medicinal plants that can be carried out by women who not only earning a living but at the same time they doing planting.

The Diversity of Edible and Medicinal Plants

The total medicinal plants traded were 120 species, 93 genera, and 49 families (Table 1). The number of species that were sold by each trader was relatively high, with the range of six to 30 species. *Centella asiatica* (L.) Urb., *Piper betle* L., *Kaempferia galanga* L., and *Zingiber zerumbet* (L.) Roscoe ex Sm. were the most frequently cited species that are used for healthcare. The similarity of medicinal plants species was also high because the species of medicinal plants sold by the traders were rather similar. The common families of medicinal plants that were traded in the market were Zingiberaceae, Solanaceae, Fabaceae, Rutaceae, and Lamiaceae, representing 35 % of the total medicinal plants traded. These families have the highest number of species due to their roles as both food and medicine. These plants are easily available as they are cultivated locally. Although some of medicinal plants families that were sold had different species, 30 families were only represented by a single species, including Araceae, Butomaceae, Caricaceae, Compositae, Euphorbiaceae, Melastomaceae, Musaceae, Pteridophyta, and Sapotaceae.

The Traditional Knowledge by the Traders in Batu Pahat Local Markets

The medicinal plants sold in Batu Pahat local markets have been used for various medicinal purposes, including to cure cancer, diabetes, high blood pressure, cough, kidney disease, injury, fever, and appetizer and for maintaining stamina (Table 1). Interestingly, many of the documented plant species are also used in customary or rituals, such as *Piper betle* which is practiced by the local people for various events including marriage, baby shower, and also for socializing. They also believe that medicinal plants have many benefits and bring less harm to their health. The leaves were the most used part of plants (63 %). The method of preparations is vary based on the type of disease treated. In this study, the most preferred preparation techniques used by the local traders involve cooking (33 %), followed by eaten raw (28 %) and decoction (24 %). About 78 % of the preparations are administered orally.

TABLE 1. Summary of ethnobotanical information of edible and medicinal plants by the traders in Batu Pahat local markets.

Plant Families and Species	Local Name	Traditional Uses	Parts Used	Methods of Preparation	Ways of Administration
Acanthaceae					
Strobilanthes crispa Blume	Pecah Beling or Kaca	Kidney stones	Leaves	Decoction	Oral: drink
Andrographis paniculata (Burm.f.) Nees	Hempedu Bumi	Blood pressure, diabetes	Leaves	Decoction	Oral: drink
Asystasia gangetica (L.) T. Anderson	Rumput Israel	Wound	Leaves	Squeeze	Apply on wound area
Clinacanthus nutans (Burm.f.) Lindau	Belalai Gajah	Cancer, diabetes	Leaves	Decoction	Oral: drink
Justicia gendarussa Burm.f.	Gandarusa	Cough	Leaves	Decoction	Oral: drink
Amaranthaceae					
Amaranthus albus L.	Bayam	Edible	Leaves	Cook	Oral: eat
Amaryllidaceae					Oral: eat
Allium cepa L.	Daun Bawang	Edible	Leaves	Cook	Oral: eat
Allium sativum L.	Bawang Putih	Edible	Rhizomes	Cook	Oral: eat
Allium cepa var. *cepa* L.	Bawang Besar	Edible	Rhizomes	Cook	Oral: eat

Continued on next page

TABLE 1. Continued

Plant Families and Species	Local Name	Traditional Uses	Parts Used	Methods of Preparation	Ways of Administration
Allium cepa var. *aggregatum* G.Don.	Bawang Kecil	Edible	Rhizomes	Cook	Oral: eat
Anacardiaceae					
Anacardium occidentale L.	Jambu Gajus	Edible	Fruits	Raw	Oral: eat
Annonaceae					
Annona muricata L.	Durian Belanda	Fever, cancer, blood pressure	Leaves, fruits	Raw, decoction	Oral: drink, bath
Apiaceae					
Apium graveolens L.	Daun Sup	Kidney disease	Leaves	Blend	Oral: drink
Petroselinum crispum (Mill.) Nyman ex A.W.Hill	Parsley	Edible	Leaves	Cook	Oral: eat
Coriandrum sativum L.	Daun Ketumbar	Edible	Leaves	Cook	Oral: eat
Oenanthe javanica (Blume) DC.	Daun Salom	Edible	Leaves	Cook	Oral: eat
Centella asiatica (L.) Urb.	Pegaga	Postnatal care, pregnancy, nerve, blood pressure	Leaves	Raw, decoction, blend	Oral: drink
Daucus carota L.	Lobak Merah	Good vision	Fruits	Blend	Oral: drink
Araceae					
Colocasia esculenta (L.) Schott	Sulur Keladi	Edible	Leaves	Cook	Oral: eat
Asphodelaceae					
Aloe vera (L.) Burm.f.	Aloe vera	Beauty, wound, dandruff	Leaves	Sap collected	Apply on wound area, apply on head, apply on face
Asteraceae					
Bidens pilosa L.	Kancing Baju	Maintain women stamina	Leaves	Decoction	Oral: drink
Gynura procumbens (Loun.) Menn.	Sambung Nyawa	Heart problem	Leaves	Raw	Oral: eat
Cichorium pumilum Jacq.	Daun Olio	Edible	Leaves	Cook	Oral: eat
Stevia rebaudiana (Bertoni) Bertoni	Stevia	Diabetes	Leaves	Decoction	Oral: drink
Blechnaceae					
Stenochlaena palustris (Burm.f.) Bedd.	Pucuk Paku Merah	Edible	Leaves	Cook	Oral: eat
Brassicaceae					
Brassica oleracea L.	Kobis	Edible	Leaves	Cook	Oral: eat
Brassica juncea (L.) Czern.	Sawi	Edible	Leaves	Cook	Oral: eat
Butomaceae					
Limnocharia flava L.	Paku Rawan	Edible	Leaves	Cook	Oral: eat
Camiaceae					
Orthosiphona ristatus (Blume) Miq.	Misai Kucing	Blood pressure, diabetes	Leaves	Dried out, tea	Oral: drink

Continued on next page

TABLE 1. Continued

Plant Families and Species	Local Name	Traditional Uses	Parts Used	Methods of Preparation	Ways of Administration
Clusiaceae					
Garcinia atroviridis Griff. Ex. T.Anderson	Asam Gelugor or Keping	Edible	Fruits	Cook	Oral: eat
Garcinia mangostana L.	Manggis	Maintain eggs colour	Leaves	Decoction	Cook
Combretaceae					
Bucida guceras L.	Pokok Doa	Medicine	Leaves	Uncertainty	Uncertainty
Commenlinaceae					
Murdannia bracteata (C.B.Clarke) J.K.Morton ex D.Y.Hong	Rumput Beijing	Soft the meat, cancer	Leaves	Decoction	Oral: drink, cook
Compositae					
Cosmos caudatus Kunth.	Ulam Raja	Cancer, diabetes, blood pressure	Leaves	Raw	Cook
Convolvulaceae					
Ipomea aquatica Forssk.	Kangkung	Edible	Leaves	Cook	Oral: eat
Cucurbitaceae					
Cucumis sativus L.	Timun Batang	Edible	Fruits	Cook	Oral: eat
Luffa acutangula (L.) Poxb.	Petola	Edible	Fruits	Cook	Oral: eat
Momordica charantia L.	Peria Katak	Blood pressure	Leaves	Blend	Oral: drink
Dioscoreaceae					
Dioscorea hispida Dennst.	Ubi Gadong or Yam	Edible	Fruits, rhizomes	Cook, raw	Oral: eat
Euphorbiaceae					
Manihot esculenta Crantz	Ubi Kayu or Pucuk	Edible	Fruits, rhizomes	Cook, raw	Oral: eat
Fabaceae					
Christia vespertillonis (L.f.) Bakh.f.	Rama-Rama Hijau	Cancer, diabetes, blood pressure	Leaves	Dried out, tea	Oral: drink
Archidendron pauciflorum (Benth.) J.C.Nielsen	Jering	Edible	Fruits	Raw, cook	Oral: eat
Sesbania grandiflora (L.) Pers.	Daun Turi	Postnatal care	Leaves	Raw	Put in surrounding
Psophocarpus tetragonolobus (L.) DC.	Kacang Botol	Cancer	Leaves	Raw	Oral: eat
Adenanthera pavonina L.	Saga	Wound	Leaves	Pound	Apply on wound area
Parkia speciosa Hassk.	Petai	Edible	Fruits	Cook	Oral: eat
Vigna unguiculata (L.) Walp.	Kacang Panjang	Edible	Fruits	Cook	Oral: eat
Geraniaceae					
Pelargonium radula (CAV.) L'Her.	Jeremin	Mosquitoes repellent	Leaves	Raw	Put in surrounding
Gnetaceae					
Gnetum gnemon L.	Belinjau	Crisp	Fruits	Cook	Oral: eat

Continued on next page

TABLE 1. Continued

Plant Families and Species	Local Name	Traditional Uses	Parts Used	Methods of Preparation	Ways of Administration
Lamiaceae					
Premna foetida Reinw. Ex Blume	Bebuas	Edible	Leaves	Cook	oral: eat
Melissa officinalis L.	Lemon Balm or Pudina	Cough	Leaves	Decoction	Oral: drink
Mentha spicata L.	Mint	Cough	Leaves	Maceration	Oral: drink
Ocimum basilicum L.	Selasih or Basil	Cholestrol	Leaves	Uncertainty	Uncertainty
Coleus blumei Benth.	Ati-Ati	Medicine	Leaves	Uncertainty	Uncertainty
Pogostemon cablin (Blanco) Benth.	Nilam	Breast cancer, headaches, perfumes, snake repellent	Leaves	Raw	Put in surrounding, poultice on forehead, poultice on breast
Thymus vulgaris L.	Thyme	Medicine	Leaves	Uncertainty	Uncertainty
Rosemarinus officinalis L.	Rosemary	Medicine	Leaves	Uncertainty	Uncertainty
Lythraceae					
Punica granatum L.	Delima	Pregnancy, good vision, crying babies	Fruits, Leaves	Raw, maceration	Oral: eat, bath
Myrtaceae					
Baeckea frustascens L.	Cucur Atap	Medicine	Leaves	Uncertainty	Uncertainty
Syzygium aromaticum (Z.) Merr. & L.M.Perry	Cengkih	Beauty	Leaves	Uncertainty	Uncertainty
Syzygium polyanthum (Wight) Walp.	Pokok Salam	Cancer	Leaves	Raw	Oral: eat
Psidium guajava L.	Jambu Batu	Anemia	Fruits	Raw	Oral: eat
Syzygium samarangese (Blume) Merr. & L.M.Perry	Jambu Loceng or Air	Stomach ache	Leaves	Decoction	Oral: drink
Melastomaceae					
Melastoma malabathricum L.	Senduduk Putih	Attract bees	Flowers	Raw	Put in surrounding
Meliaceae					
Azadirachta indica A. Juss.	Neem or Semambu	Chicken pox, cosmetic, oil ailment,	Leaves	Raw, decoction	Put on bed, bath
Moraceae					
Morus nigra L.	Mulberry	Heart problem, diabetes	Leaves	Raw, decoction, dried out	Oral: drink, oral: eat
Artocarpus altilis (Parkinson ex F.A.Zom) Fosberg.	Sukun	Cancer	Leaves	Dried out and tea, decoction	Oral: drink
Artocarpus heterophyllus Lam.	Nangka	Soft the chicken meat	Leaves	Decoction	Cook
Ficus deltoidea Jack	Mas Cotek	Blood pressure, beauty, cancer	Leaves	Raw, decoction, dried out	Oral: drink, oral: eat

Continue to the next page

TABLE 1. Continued

Plant Families and Species	Local Name	Traditional Uses	Parts Used	Methods of Preparation	Ways of Administration
Ficus carica L.	Tin or Pokok Ara	Blood pressure, diabetes	Leaves	Dried out, tea	Oral: drink
Musaceae					
Musa sp.	Jantung Pisang	Edible	Fruits	Cook	Oral: eat
Oxalidaceae					
Averrhoa bilimbi L.	Belimbing Buluh	Cough	Fruits	Juice	Oral: drink
Averrhoa carambola L.	Belimbing Besi	Thyroid	Fruits	Uncertainty	Uncertainty
Passifloraceae					
Passiflora edulis Sims.	Markisa	Body cooler	Fruits	Blend	Oral: drink
Phyllanthaceae					
Phyllanthus acidus (L.) Skeels	Cermai	Chickenpox	Leaves	Pound	Apply on skin area
Phyllanthus niruri L.	Dukung Anak	Medicine	Leaves	Uncertainty	Uncertainty
Sauropus androgynus (L.) Merr.	Pucuk Manis	Blood pressure	Leaves	Raw	Oral: eat
Piperaceae					
Piper betle L.	Sireh	Postnatal care, crying babies, maintain women stamina, beauty	Leaves	Decoction, heat up the leaves, raw	Oral: drink, bath, cleaning, apply on stomach
Peperomia pellucida (L.) Kunth.	Sireh Cina	Medicine	Leaves	Uncertainty	Uncertainty
Piper sarmentosum Roxb.	Kaduk	Medicine	Leaves	Uncertainty	Uncertainty
Poaceae					
Cymbopogon citrate (DC.) Stapf.	Serai	Fever, freshing body	Leaves	Decoction, maceration	Oral: drink, bath
Bambusa vulgaris Schrad. ex J.C.Wendl.	Rebung	Stroke attack	Leaves	Raw	Oral: eat
Polygonaceae					
Antigonon leptopus Hook. & Arn.	Kelulut or Air mata Pengantin	Cough, attract bees	Leaves, flowers	Raw, decoction	Oral: drink, put in surrounding
Persicaria minor (Huds.) Opiz	Daun Kesum	Appetizer	Leaves	Raw	Oral: eat
Primulaceae					
Labisia pumila Benth. & Hook.f.	Kacip Fatimah	Maintain women stamina	Leaves	Uncertainty	Uncertainty
Pteridophyta					
Pityrogramma calomelanos (L.) Link	Pucuk Paku Perak	Edible	Leaves	Cook	Oral: eat
Rhamnaceae					
Ziziphus mauritiana Lam.	Bidara	Mistic activities,	Leaves, fruits	Squeeze, raw	Oral: eat, bath

Continue to the next page

TABLE 1. Continued

Plant Families and Species	Local Name	Traditional Uses	Parts Used	Methods of Preparation	Ways of Administration
Rubiaceae					
Morinda citrifolia L.	Pucuk Mengkudu	Blood pressure	Leaves	Raw	Oral: eat
Rutaceae					
Citrus microcarpa Bunge	Limau Kasturi	Dizziness	Fruits	Squeeze	Smell
Citrus hystrix DC.	Limau Purut	Dandruff, perfumes	Fruits	Squeeze	Bath, apply on head
Citrus aurantiifolia (Christm.) Swingle	Limau Nipis	Dizziness, postnatal care, flat stomach	Fruits	Squeeze	Smell, bath, apply on stomach
Murraya koenigii (L.) Spreng.	Daun Kari	Burn calories	Leaves	Raw	Oral: eat
Ruta chalepensis L.	Garuda	Hysteria, mosquitoes repellent, crying babies, mystical	Leaves	Raw	Cook, oral: drink, apply, put in surrounding
Citrus maxima (Burm.) Merr.	Limau Bali	Edible	Fruits	Raw	Oral: eat
Euodia ridleyi Hochr.	Tenggek Burung	Blood pressure, slimming, calcium	Leaves	Decoction, raw	Oral: drink, oral: eat
Citrus limon (L.) Burm.f.	Lemon	Cough, diabetes, flu	Fruits	Squeeze, juice	Oral: drink
Sapindaceae					
Nephelium mutabile Blume	Pulasan	Edible	Fruits	Cook	Oral: eat
Sapotaceae					
Synsepalum dulcificum (Schumach. & Thonn.) Daniell	Pokok Seribu Rasa or Ajaib	Appetizer, postnatal care, sweetener	Leaves	Raw, blend	Oral: drink, bath
Schizophyllaceae					
Schizophyllum commune Fries	Cendawan Kukur	Edible	Leaves	Cook	Oral: eat
Simaroubaceae					
Eurycoma longifolia Jack	Tongkat Ali	Cancer, maintain men stamina	Roots	Decoction	Oral: drink
Solanaceae					
Capsicum frutescens L.	Cili	Acne, burn calories	Fruits	Pound, raw	Apply on skin, oral: eat
Solanum melongena L.	Terung Putih	Edible	Fruits	Cook	Oral: eat
Solanum americanum Mill.	Pucuk Meranti	Postnatal care	Leaves	Cook	Oral: eat
Solanum torvum Sw.	Terung Pipit	Good vision	Fruits	Cook	Oral: eat
Solanum tuberosum L.	Ubi Kentang	Edible	Fruits	Cook	Oral: eat
Solanum melongena L.	Terung Purple	Edible	Fruits	Cook	Oral: eat
Solanum lycopersicum L.	Tomato	Edible	Fruits	Cook	Oral: eat
Zingiberaceae					
Zingiber officinale Roscoe	Halia Bentong or Biasa	Cholestrol	Rhizomes	Uncertainty	Uncertainty

Continue to the next page

TABLE 1. Continued

Plant Families and Species	Local Name	Traditional Uses	Parts Used	Methods of Preparation	Ways of Administration
Kaempferia elegans (Wall.) Balcer	Cekur Batik or Hitam	Women health, beauty	Rhizomes	Uncertainty	Uncertainty
Boesenbergia rotunda (L.) Mansf.	Temu Kunci	Maintain women stamina	Rhizomes	Blend	Oral: drink
Curcuma zanthorrhiza Roxb.	Temu Lawak	Beauty	Rhizomes	Blend, pound	Apply on skin
Curcuma mangga Valeton and Zijp	Temu Pauh	Edible	Rhizomes	Cook	Oral: eat
Curcuma zedoaria (Christm.) Roscoe	Kunyit Putih	Maintain women stamina	Rhizomes	Blend	Oral: drink
Alpinia galanga (L.) Willd.	Lengkuas	Edible	Rhizomes	Cook	Oral: eat
Etlingera elatior (Jack) R.M.Sm.	Bunga Kantan	Antioxidant	Leaves	Cook	Oral: eat
Zingiber zerumbet (L.) Roscoe ex Sm.	Lempoyang	Appetizer	Rhizomes	Decoction, blend	Oral: drink
Curcuma caesia Roxb.	Kunyit Hitam	Cancer, thyroid	Rhizomes	Blend, pound	Oral: drink
Curcuma longa L.	Kunyit kuning	Postnatal care, cancer, beauty, period pain	Rhizomes	Blend, decoction	Oral: drink
Kaempferia galanga L.	Cekur	Beauty, sweetener, appetizer, postnatal care	Fruits, Leaves	Maceration, blend	Oral: drink

CONCLUSION

In conclusion, an ethnobotanical survey of edible and medicinal plants indicates that Batu Pahat is still rich with its native medicinal plant's composition and associated traditional knowledge. There were 120 species of edible and medicinal plants reported as being sold by the local traders in Batu Pahat local markets. The local traders are knowledgeable about the uses of the plants although a few uncertainties were recorded. Ethnobotanical knowledge documented from the local traders in these markets suggest a potential approach to obtain the native and exotic flora of Batu Pahat region, thereby aiding plans to conserve commercialized resources. Hence, the documentation plays an important role in preserving the culture and value of local plants.

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