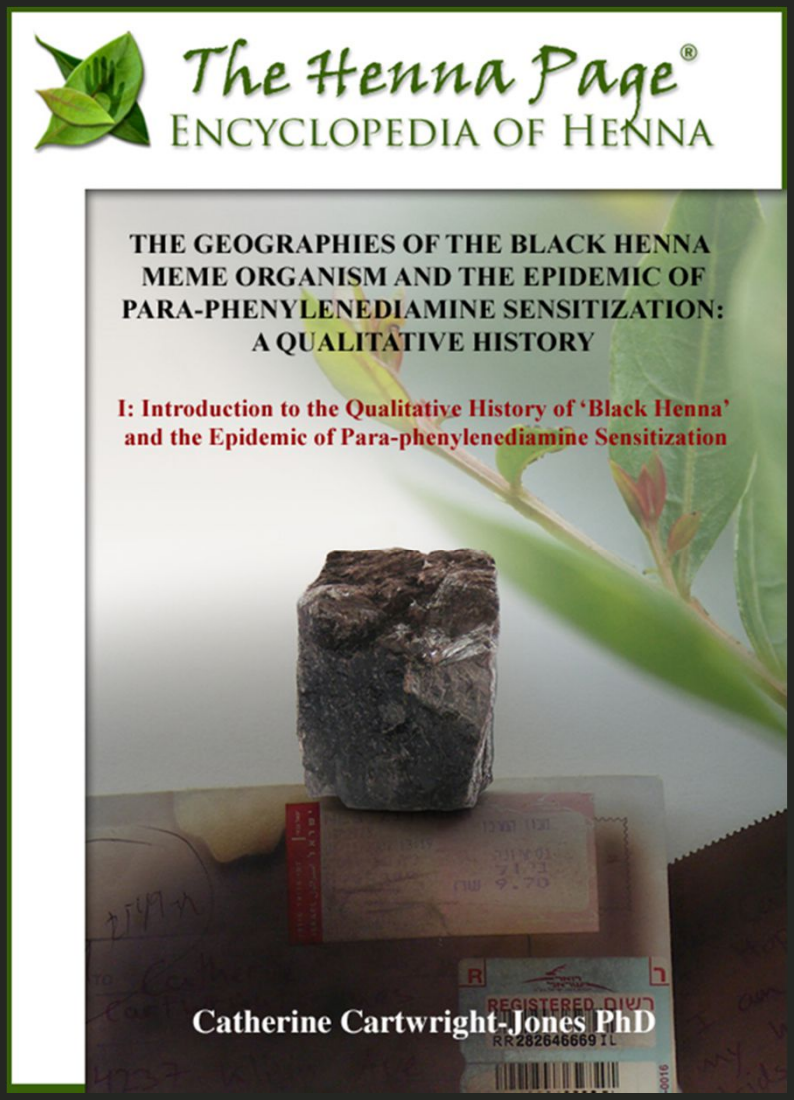
‘BLACK HENNA’ AND THE EPIDEMIC OF PARA-PHENYLENEDIAMINE SENSITIZATION

Demographics of Extreme Allergic Reactions to Oxidative Hair Dye

by Catherine Cartwright-Jones PhD

The scope of this presentation

- What is ‘black henna’?
- Where and when did ‘black henna’ begin?
- What is the risk assessment?
- Why hasn’t a government stopped ‘black henna’?
- How did this become a global problem?
- Are there differences in religion, culture, and gender?
- How will this affect the chemical hair dye industry?



Henna is NOT black

- Henna is *lawsonia inermis*, a plant which contains 0.5% to 2% lawsone, a red-orange napthaquinone molecule which readily, harmlessly, stains keratin. Henna paste applied for 3 to 8 hours to hair or skin will leave an orange to dark brown stain.
- ‘Black Henna’ is created by applying para-phenylenediamine to skin.
- PPD at high concentrations stains skin black in 1 hour.

How did this happen?

- Henna was a beloved, safe, cultural tradition for 6,000 years.
- PPD was considered more modern and more convenient than henna.
- ‘Black henna’ temporary tattoos are created with paste containing 12.5% to 80% PPD. (1) (2)
- In 1966, Kligman found that a 10% PPD patch test sensitizes 100% of subjects in 5 or fewer applications. (3)

Case Study: ‘Black henna’, then hair dye









When this person was a twelve years old, he got a ‘black henna’ temporary tattoo when on vacation in Grand Cayman with his parents. It blistered and itched, but no particular significance was attached to the itching; the pediatrician did not advise about a sensitization to oxidative hair dye. When he was sixteen, he asked to dye his hair black on December 30. He was hospitalized January 1 with eyes swollen shut, mouth swollen, and air passages restricted. He gradually recovered.

‘Black henna’ temporary tattoos are a major source of the global epidemic of PPD sensitization.

- As of 2015, I estimate that there are 150,000,000 individuals who have been sensitized to PPD through vacation souvenir ‘black henna’ temporary tattoos, and a much larger number have been sensitized through cultural use.(4)
- ‘Black henna’ temporary tattoos cause extreme sensitization reactions to oxidative hair dye because of the shared chemical, PPD.

Assessing the risk over time

1995

2020

2030

Had ‘black henna’

- The PPD sensitization rate among children in Manchester UK has risen from 8% in 2005 to 16% in 2014.(5) If these people apply oxidative hair dye to cover gray in 2030, 16% may have an allergic reaction. 7% of them may have a severe reaction requiring hospitalization.
- If a person has a ‘black henna’ temporary tattoo, that person has about a 50% chance of being sensitized to oxidative hair dye. (6)
- **If a person is sensitized by ‘black henna’ that person has a 40% chance of a +++ (severe) reaction.(7)**
- These reactions have already presented with greater severity than previously seen with hair dye allergies.(8) Subjects may require hospitalization;(9) Anaphylaxis reactions may be fatal.(10)

Origin and Dispersion of ‘Black Henna’

- The fashion for ‘black henna’ temporary tattoos began in the 1970’s in East Africa.(11)
- Diasporic communities preferring ‘black henna’ have high rates of sensitization.

Delayed hypersensitivity reactions mask the risk; the risk is unrecognized.

- 3 to 30 days after PPD application, people present to ER with massive blistering from ‘black henna’. (12)
- Artists do not know ‘black henna’ has an extremely high PPD content.
- Patrons believe henna to be harmless and natural.
- Physicians’ diagnoses and treatments were often incorrect.

‘Black henna’ causes cross-sensitization to similar chemicals.

- A high percentage of people sensitized to para-phenylenediamine by ‘black henna’ are cross-sensitized to similar chemicals, other coal tar dyes, perfumes, PABA sun block, rubber products, azo dyes, and even black shoes and clothing. (13)
- ‘Low PPD’ and ‘no PPD’ oxidative hair dyes give a false sense of security and may contribute to injuries. (14)

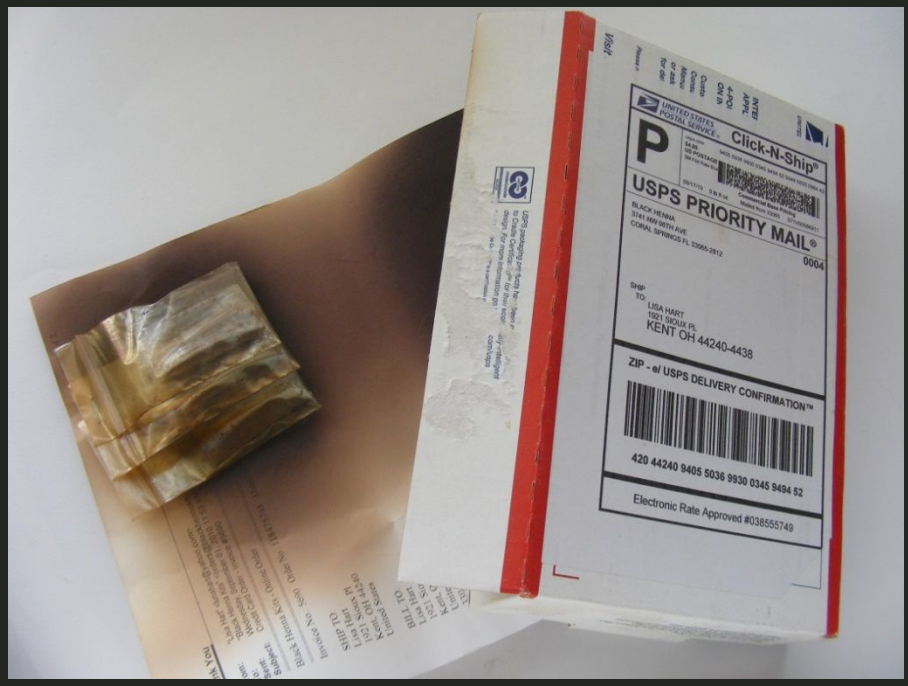
‘Black Henna’ is NOT legal, but thrives in seasonal informal economies

- Laws against ‘black henna’ exist, but are unenforceable.
- Countries in the Arabian Peninsula have strict laws against ‘black henna’, but people who want it can get it because the materials are easy to obtain.
- ‘Black henna’ wedding artists usually go to the client’s house.
- ‘Black henna’ artists often work from folding tables on the street or other temporary locations.
- ‘Black henna’ artists often vend on beaches, carrying their kit with them.

Seasonal Beach Shops

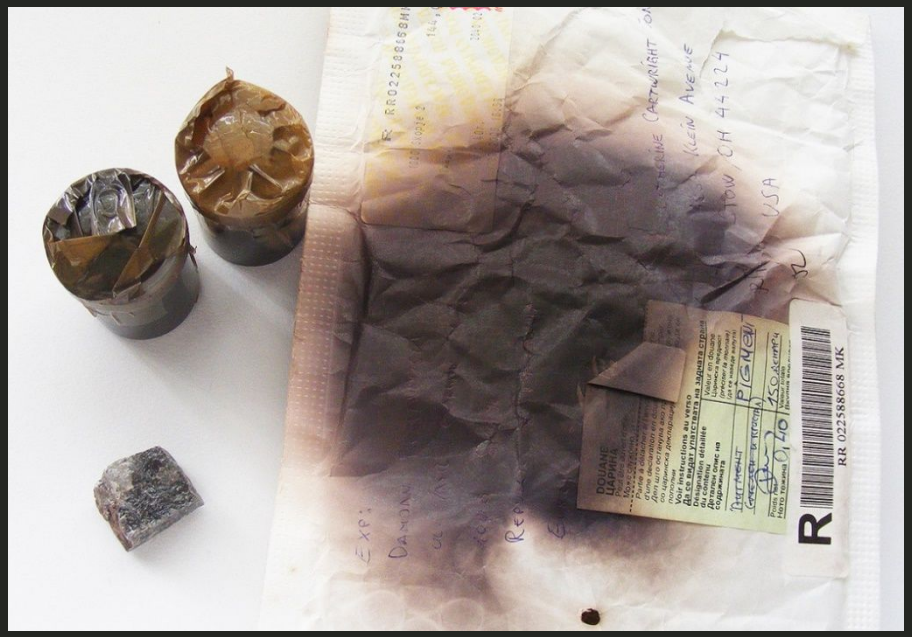
- Daytona Beach ‘Black Henna’ shown below: laws are ignored
- An estimated 300 shops in Myrtle Beach do ‘Black Henna’ tattoos.
- Regulation has been attempted and has largely failed.

Easy Availability



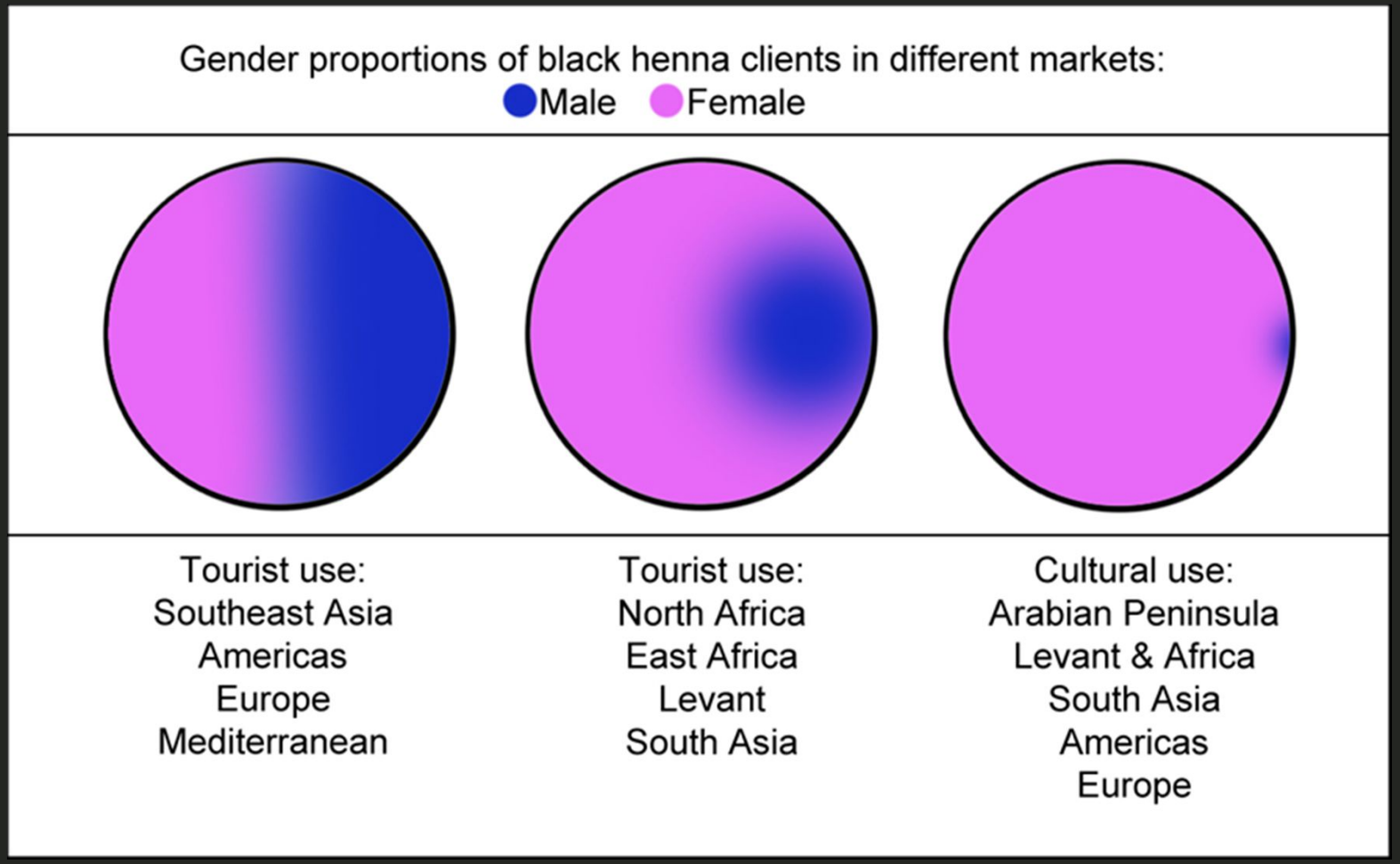
- The above products are commonly used to make a ‘black henna’ paste from 12.5% to 30% PPD. All of these can be purchased online, in salon supply shops, or in ethnic grocery stores. (15)
- Cosmetic law in India permits 30% PPD in ‘black henna’.(16)
- USFDA regulations on PPD sold for ‘black henna’, even prosecutions, have been ignored. (17)

‘Henna Stone’ and Piku



- The highest PPD content ‘black henna’ temporary tattoos are made from chunks of industrial para-phenylenediamine called “henna stone” or “German stone” or “henna stone from the banks of the Nile” are available in markets in the Levant, Africa, and the Arabian Peninsula. PPD content of ‘henna stone’ is 84.89% to 90.9%. (18)
- Peacock black hair dye is frequently used as ‘black henna’ across Africa.

‘Black Henna’ in Tourism and Cultural Practice



- ‘Black henna’ is differently gendered in culture and tourism
- Sensitization to hair dye and other coal tar derivatives will follow.(19)

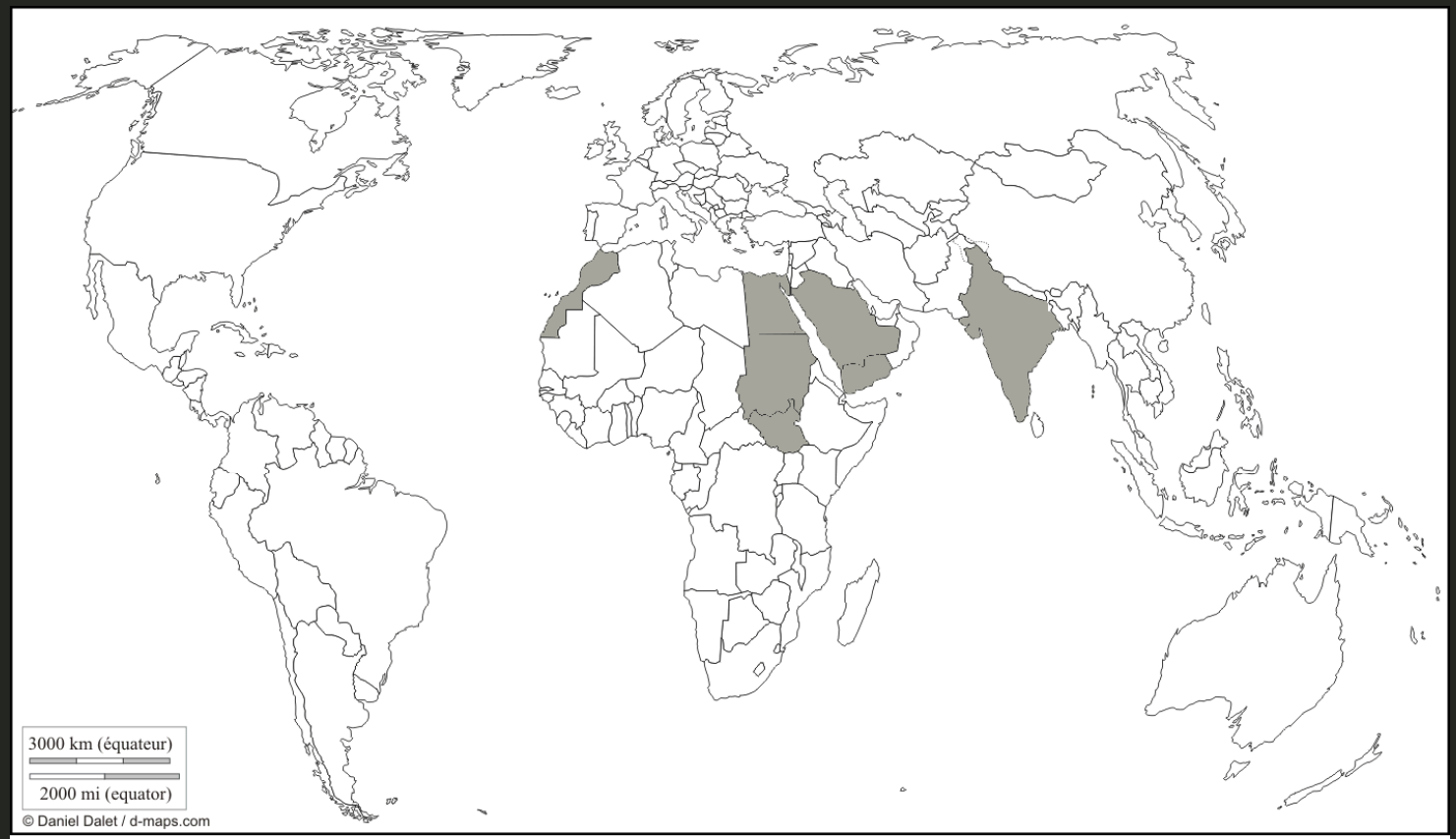
‘Black Henna’ in Tourism and Cultural Practice

- Groups which have incorporated ‘black henna’ into female henna traditions have extremely high PPD sensitization rates.
- Groups who emulate masculine black ‘tribal tattoos’ have higher male sensitization to PPD.
- Children may have more severe sensitization rates.

Map of PPD ‘black henna’ in 1975

- Bigen and Peacock home hair dye replaced or augmented henna to create black bridal henna: early physicians’ reports suspected PPD.(20)

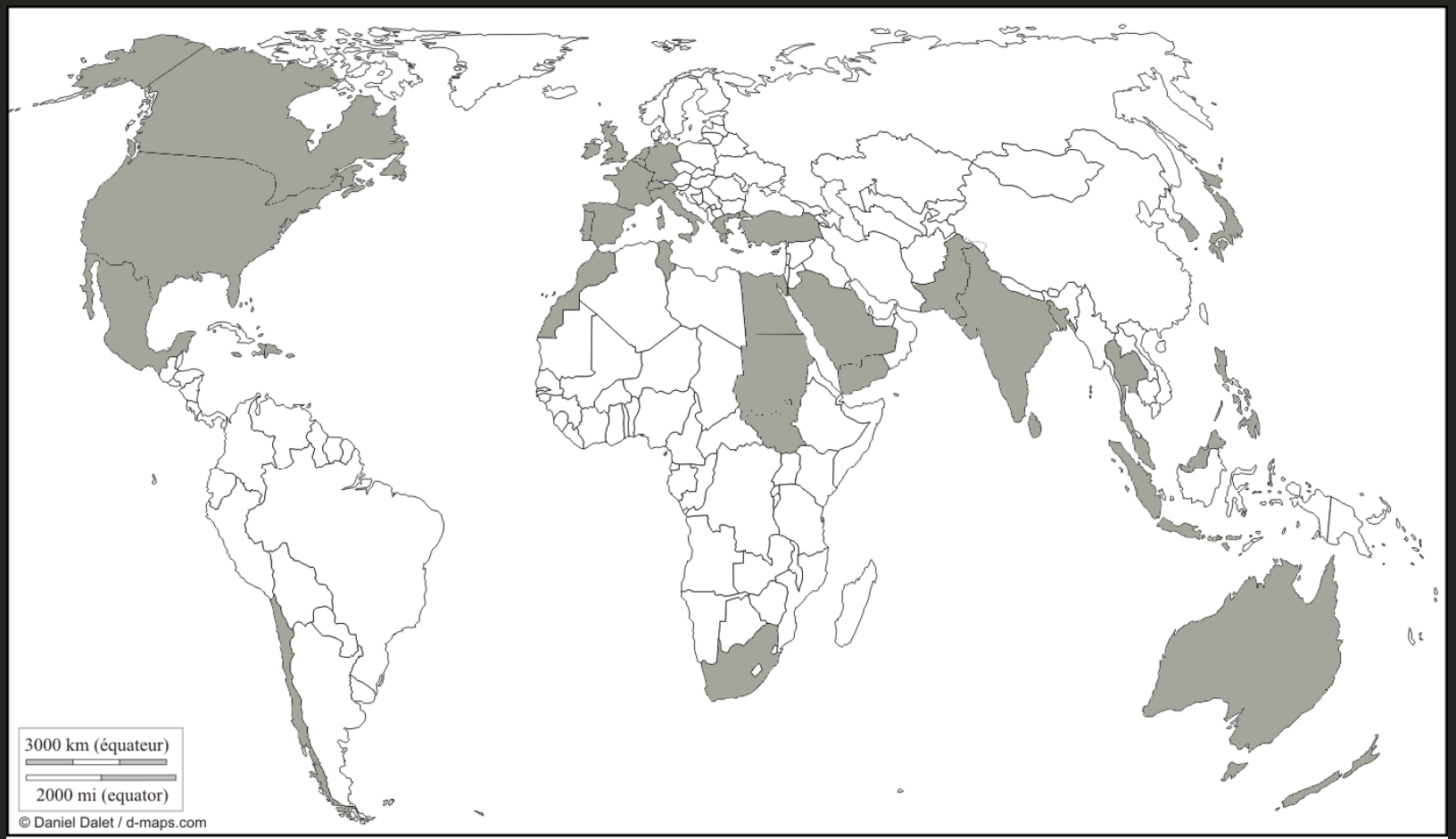
Map of ‘black henna’ in 1985



Countries with evidence of para-phenylenediamine being used to create black temporary tattoos in the 1980’s, based on English language sources.

- PPD ‘black henna’ spread through women’s social networks: early injuries reported in East and North Africa and South Asia.
- Gender, culture, and language differences slowed diagnosis.

Map of *'black henna'* in 1999



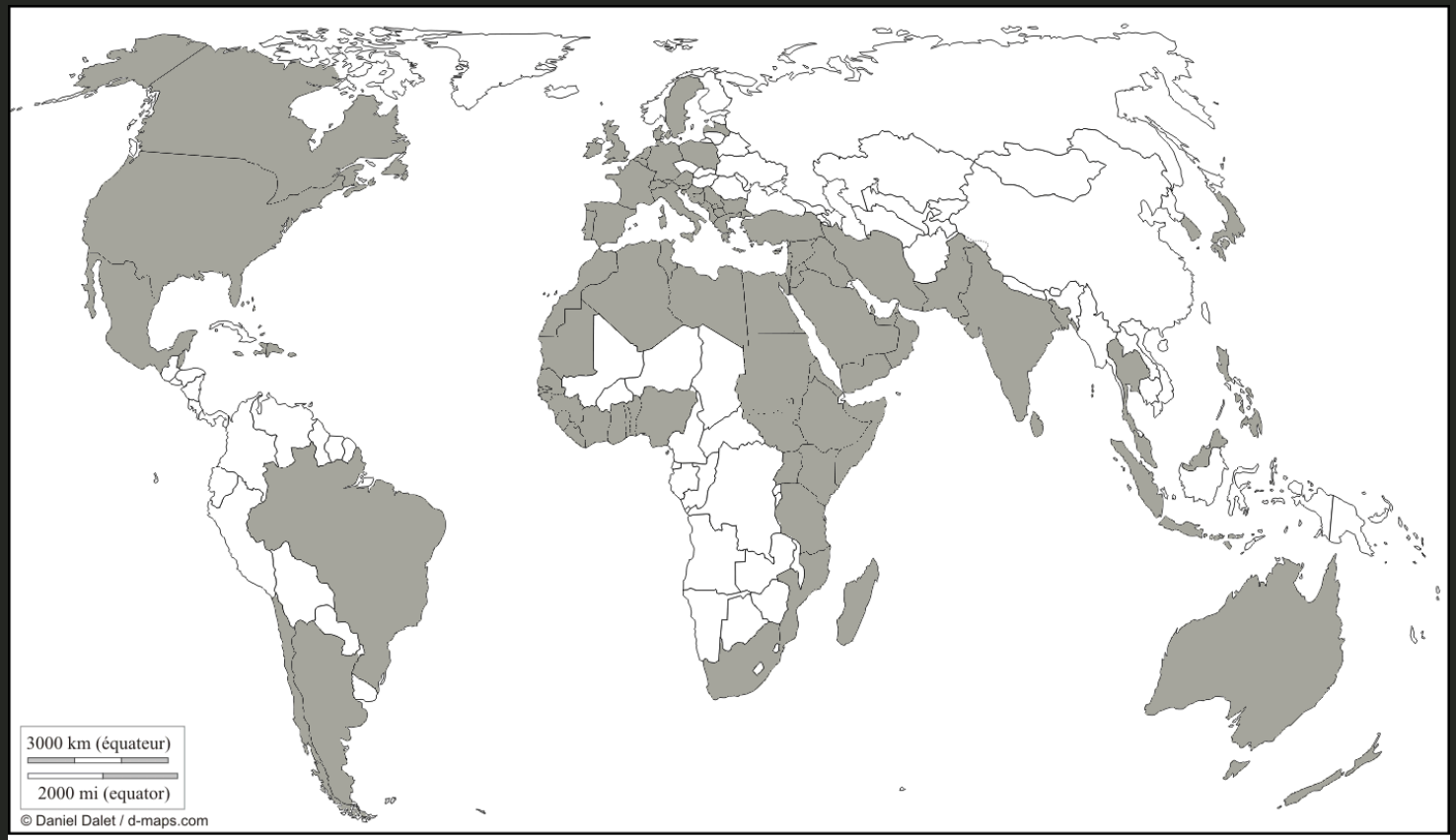
Countries with evidence of para-phenylenediamine being used to create black temporary tattoos between 1996 and 1999, based on English language sources.

- 'Black henna' globalized through tourism and popular culture.

Instant globalization through pop culture

- The black henna fashion spread gradually from 1970's to the mid 1990's
- February 1998, 'Frozen' video was released on MTV and 'black henna' globalized overnight.
- Pop music and celebrity
- News media

Map of ‘black henna’ use in 2013: subsequent rise in extreme hypersensitivity reactions to hair dye is inevitable.

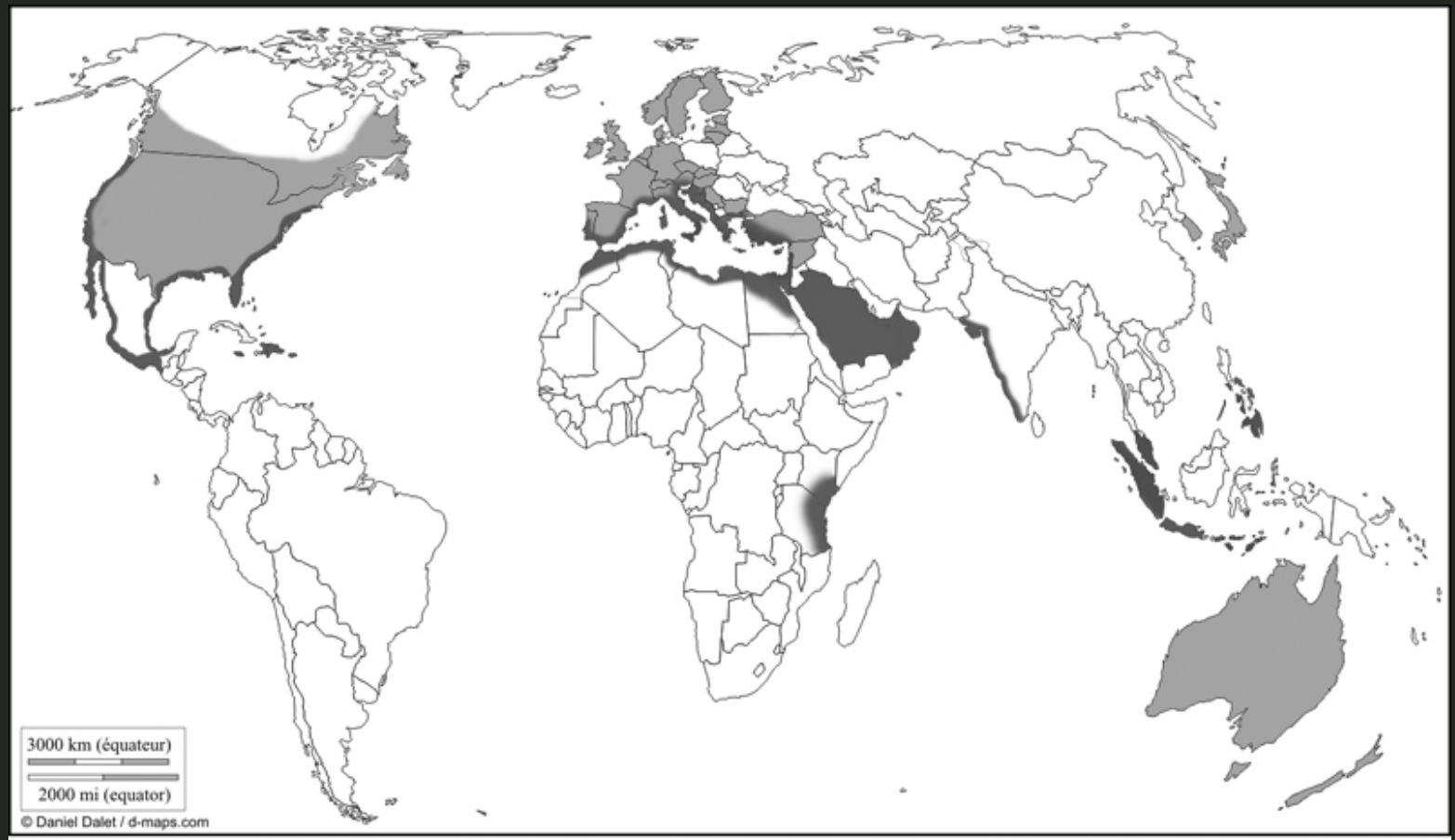


Countries with evidence of para-phenylenediamine being used to create black temporary tattoos between 2000 and 2013, based on English language sources.

Sensitization map: culture and diaspora

- Cultural use of 'black henna' occurs at weddings, Eids, Diwali, and festivals.
- Adult females frequently use 'black henna' in cultural practice.

Areas of ‘black henna’ activity in informal tourism economies: host and donor countries



Areas of tourism where para-phenylenediamine ‘black henna’ is widespread in the informal economy

Populations patronizing areas of tourism where para-phenylenediamine ‘black henna’ is widespread in the informal economy.

The PPD sensitization epidemic cannot be stopped.

- ‘Black henna’ is too profitable and desirable for people to take warnings seriously.
- PPD is easily available.
- People do not recognize the hazard because of the delayed reaction.
- ‘Black henna’ is in the informal economy and regulations are unenforceable.
- People are typically unaware that there is a link between ‘black henna’ and oxidative hair dye. Injuries will be severe and unanticipated.
- People are increasingly sensitized to oxidative hair dye and there will an increase in hospitalizations and fatalities. This will have an adverse fiscal impact on the chemical cosmetic industry.

2030

- According to my research, by 2030, 4% to 40% (depending on demographics) of potential consumers of oxidative hair dye may be severely sensitized; if they use coal-tar derivative or oxidative hair dye, they may be seriously injured.
- Non-coal tar derivative materials and techniques for permanent, non-fading hair dye are available, but they do not scale easily in industrial capitalist frameworks, are under-developed and poorly understood.
- The plant-based dye products presently in the marketplace function poorly because of inherent resource unreliability and inadequate praxis.
- A solution exists that can serve sensitized clients; it will require education, infrastructure, and development.

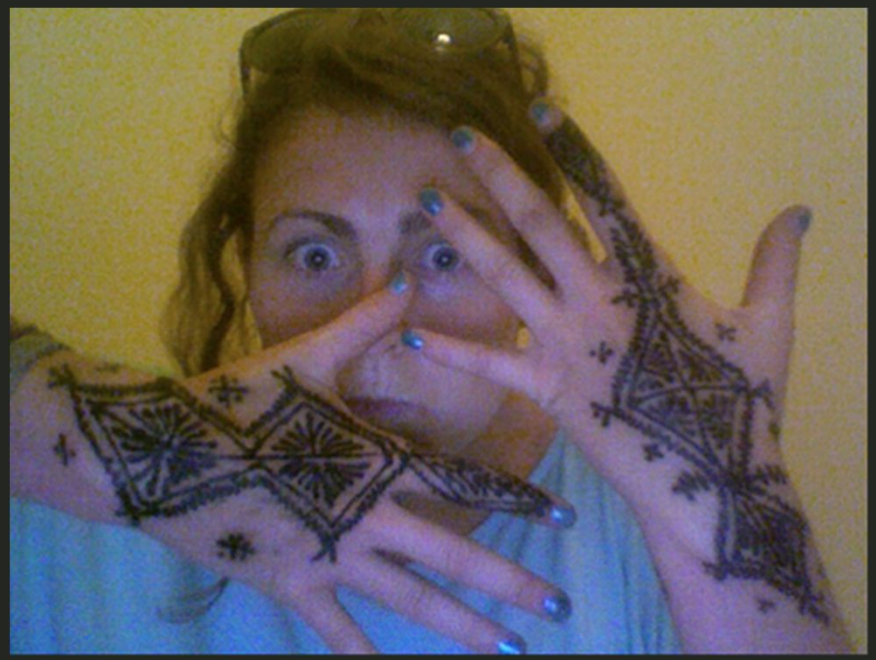
Methodology and References

for

‘BLACK HENNA’ AND THE EPIDEMIC OF PARA-PHENYLENEDIAMINE SENSITIZATION

Research methods

- Online discussion: highly granular and personal
- Blogs
- Forums
- News commentary
- Vendors
- Informal economies
- Medical journals
- Artists
- Travel



Constructing the numbers

- Assemble the epidemiology of *black henna*, with replication and evolution through time and space
- Requires large datasets and careful qualitative analysis
- Online capta may be ephemeral: log everything completely with context
- Challenges of uneven geographies of nodes and flows
- Wherever one can find the 'black henna', sensitization WILL follow.

References

1. Almeida, Pablo J., et al. 2012. “Quantification of p-phenylenediamine and 2-hydroxy-1,4-naphthoquinone in henna tattoos.” Contact Dermatitis 66, no. 1:33-37.
2. Brancaccio, R.R., et al. “Identification and quantification of para-phenylenediamine in a temporary black henna tattoo.” American Journal of Contact Dermatitis, v. 13 issue 1, 2002, p. 15-8.
3. Kligman, A. M. 1966. “The identification of contact allergens by human assay. 3. The maximization test: a procedure for screening and rating contact sensitizers.” Journal of Investigative Dermatology, v. 47 issue 5, p. 393-409. (1966)
4. Cartwright-Jones, C.. “The Geographies of the Black Henna Meme Organism and the Epidemic of para-Phenylenediamine Sensitization: A Qualitative History.” PhD dissertation. Kent State University (2015)
5. Smith V, Clark S, and Wilkinson M. “Allergic contact dermatitis in children: trends in allergens, 10 years on. A retrospective study of 500 children tested between 2005 and 2014 in one U.K. centre.” *British Association of Dermatologists’ Annual Conference*. Leeds Teaching Hospitals NHS Trust, Leeds, U.K. (*2015*).

6. Star Tribune. “Temporary tattoos put blisters on metro kids” *Star Tribune*, July 2, 2011. Minneapolis, MN, accessed December 24, 2011, http://www.startribune.com/local/124797314.html
7. Spornraft-Ragaller, Petra, Axel Schnuch, and Wolfgang Uter. 2011. "Extreme patch test reactivity to p-phenylenediamine but not to other allergens in children." *Contact Dermatitis* (01051873) 65, no. 4: 220-226.
8. Sosted, Heidi, et al. 2006. Severe allergic hair dye reactions in 8 children. *Contact Dermatitis* 54, no. 2:87-91
9. Onder, M. 2003. "Temporary holiday“tattoos” may cause lifelong allergic contact dermatitis when henna is mixed with PPD." *Journal Of Cosmetic Dermatology* 2, no. 3/4: 126-130.
10. Broides A, Sofer S, Lazar I. 2011 “Contact dermatitis with severe scalp swelling and upper airway compromise due to black henna hair dye.” *Pediatric Emergency Care*, 2011 Aug; 27(8):745-6 Pediatric Emergency Department, Ben-Gurion University, Be'er-Sheva, Israel.
11. Hashim, S., Hamza, Y., Yahia, B., Khogali, F., and Sulieman, G., 1992 "Poisoning from Henna Dye and Para-phenylenediamine Mixtures in Children in Khartoum" *Annals of Tropical Pediatrics* 12, 3 – 6

12.Sonnen, G. “Type IV hypersensitivity reaction to a temporary tattoo.” Proceedings (Baylor University. Medical Center), v. 20 issue 1, 2007, p. 36-8.

13.Schultz, E.; Mahler, V. “Prolonged lichenoid reaction and cross-sensitivity to para-substituted amino-compounds due to temporary henna tattoo.” International Journal of Dermatology, v. 41 issue 5, 2002, p. 301-3.

14.Ingram, John R., T. Meirion Hughes, and Natalie M. Stone. "Potential danger of hair dyes marketed as free from para-Phenylenediamine." International Journal Of Dermatology 53, no. 4: e257-e258. (2014)

15.Ik-Joon, Kang, and Lee Mu-Hyoung. 2006. "Quantification of para-phenylenediamine and heavy metals in henna dye." Contact Dermatitis (01051873) 55, no. 1: 26-29. Academic Search Complete, EBSCOhost (accessed December 18, 2011).

16.Gupta, Mrinal, Vikram K. Mahajan, Karaninder S. Mehta, and Pushpinder S. Chauhan. 2015. "Hair dye dermatitis and p-phenylenediamine contact sensitivity: A preliminary report." Indian Dermatology Online Journal 6, no. 4: 241-246.

17. FDA U.S. Food and Drug Administration. “Black Henna Ink, Inc.” August 14, 2006. FDA U.S. Food and Drug Administration. Department of Health and Human Services. Inspections, Compliance, Enforcement, and Criminal Investigation, accessed November 3, 2013, http://www.fda.gov/ICECI/EnforcementActions/WarningLetters/2006/ucm076032.htm)
18. Özkaya E, Yazganoglu KD, Arda A, Topkarci Z, Erçag E. 2013. The "henna stone" myth. Indian Journal of Dermatology and Venereal Leprology 79:254-6
19. Redlick, F.; DeKoven, J. “Allergic contact dermatitis to paraphenylendiamine in hair dye after sensitization from black henna tattoos: a report of 6 cases.” Canadian Medical Association Journal, v. 176 issue 4, 2007, p. 445-6.
20. Hashim, S., Hamza, Y., Yahia, B., Khogali, F., and Sulieman, G., 1992 "Poisoning from Henna Dye and Para-phenylenediamine Mixtures in Children in Khartoum" *Annals of Tropical Pediatrics* 12, 3 - 6

Images other than collection of Catherine Cartwright-Jones PhD

- Slide 4: Catherine Cartwright-Jones PhD and Reddit
- Slide 6: Kungfu-kickass. Comment, “Acute allergic reaction to henna” posted to WTF/Reddit. March 2013, http://www.reddit.com/r/WTF/comments/1be5to/acute_allergic_reaction_to_henna/ http://i.imgur.com/UrnbXOv.jpg (accessed November 25, 2013)
- Slide 8: Farran, Albert González, March 30, 2013. “El Fasher: (In black dress) Fatama Abaker Bakhit, ‘Tata,’ performs a drawing on Enam Mohammed's foot with "henna."” Uploaded to UNAMID Photo’s Photostream, Flickr.com http://www.flickr.com/photos/58538810@N03/8730156123/ (accessed November 23, 2013).
  - “Woman Ends Up in Burns Unit After Allergic Reaction to Hair Dye” http://news.softpedia.com/news/Woman-Ends-Up-in-Burns-Unit-After-Allergic-Reaction-to-Hair-Dye-125692.shtml accessed November 23, 2015
  - http://www.dailymail.co.uk/health/article-2109186/Carmen-Rowe-hair-dye-Pictures-swollen-face-woman-25-allergic-reaction.html#ixzz3oIom4tqN

Images other than collection of Catherine Cartwright-Jones PhD

- Slide 9: Spider Girl. Saturday, December 23, 2006. “Spider on the Road, The Henna Incident Saturday, September 10, 2005. WARNING: DO NOT EVER USE BLACK HENNA” blogspot.com http://spidergirlontheroad.blogspot.com/2006/12/henna-incident.html
- Slide 10: Doryll Medroso. Henna. November 7, 2009. Doryll Medroso’s photostream. http://www.flickr.com/photos/doryllmedroso/4101774237/ (accessed January 7, 2013)
- Slide 12: Alyson Harris. Photos from Alyson Harris's post in PPD Free Henna Artists. Facebook. June 7, 2013. https://www.facebook.com/photo.php?fbid=10100351029251757&set=gm.644464748915528&type=1&relevant_count=2&theater (accessed September 18, 2013)
- Slide 16: Hamaden Photography
- Slide 20: Promotional photograph of Madonna, 1998, Maverick Records

Images other than collection of Catherine Cartwright-Jones PhD

- Slide 27: Top Cat. “Henna beats fingernails any day,” posted to blog January 19, 2009. We Bought a Sailboat. http://www.urbancats.com/?p=335 (accessed January 6, 2013)
  - The Cantaloupetales. “Goodbye Henna” posted to thecantaloupetales; Morocco, art, & the open road. May 16, 2012 http://thecantaloupetales.wordpress.com/tag/black-henna/ (accessed October 24, 2012
- Slide 28:Victoria Villalobos. “Debating; Venice Beach, CA.” Uploaded to Smiledarling Photostream, Flickr, November 29, 2009. http://www.flickr.com/photos/smiledarling/4284305642/ (accessed November 22, 2013).
  - Get Set Go Black Heena

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http://www.hennapage.com/henna/ccj/

Articles in academic publication

- "The Geographies of the Black Henna Meme Organism and the Epidemic of Para-phenylenediamine Sensitization: A Qualitative History.“ Kent State University 2015
- "Lawsonia inermis L. (henna): Ethnobotanical, phytochemical and pharmacological aspects," Ruchi Badoni Semwala, Deepak Kumar Semwala, Sandra Combrinck, Catherine Cartwright-Jones, Alvaro Viljoen. *Journal of Ethnopharmacology*, June 2014
- Henna Body Art in South Asia: Encyclopedia of Popular Culture in Asia and Oceania, *Greenwood Press/ABC-CLIO*
- Developing Guidelines on Henna: A Geographical Approach Master's Essay Kent State University 2015