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Exploring Biochemical Contents of Weed Aeroallergens (Pollen Grains)

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Abstract: *The primary source of protein for honey bees is pollen, which also contains fats and lipids, vitamins, minerals, and minerals in the form of bee bread. The development of young bees and the creation of brood both depend on the protein that pollen provides. The most nutrient-variable food that honey bees consume is pollen. Similar to people, honey bees have fundamental nutritional needs for proteins (amino acids), carbohydrates (sugars), minerals, fats/lipids (fatty acids), vitamins, and water. Honey bees gather nectar, pollen, and water to meet their nutritional needs.*

Keywords: *Biochemical Contents, Weed Aeroallergens, medicine*

I. INTRODUCTION

The nectar that bees collect from flowers is used to make honey, as beekeepers are aware. Nectar is transformed inside the honey stomach (stomodeum), which is located below the bee's foregut, and then expelled, either to feed the adult bees or to be stored in the combs. Pollen is the primary protein source for many solitary and colony insects, including not just bees. Therefore, pollen must be recognised as a genuine food item, or, in the words of the esteemed German dictionary "Duden," "a commodity for eating or drinking meeting the requirements of daily life."

The chemical components of pollen

It was suggested during World War II **(Vivino and Palmer, 1944)[1]** that so-called "bee bread," or pollen collected by bees and stored in the bee-hive, may provide a significant amount of wholesome food. They claimed that the amount of pollen gathered annually in the USA **(Todd and Bretherick, 1942) [2]** was comparable to the annual honey yield at the time (80000 t). Numerous studies have shown that pollen's chemical composition varies significantly, and this variation is caused by a range of plant sources, analytical methods, and seasonal variations. The way that pollen was collected, such as whether it was done manually or by bees who gathered it right from the flower, is also important **(Herbert and Shimanuki, 1978) [3].**

Table 1: Pollen grain's food-related components

Food elements in % dry weight	
Dry substance	83
Fat	11
Proteins	23
Total carbohydrates calculated as invert sugar	36
Glucose	14
Fructose	19
Ash	2.4
Lipids calculated as lecithin	1.7
Phytosterins	1.6
Others	13

Table1. gives a broad overview of the constituents of mixed pollen. More analyses of the pollen from various species were looked at by **Stanley and Linskens (1984) [4].** In terms of protein, fat, phosphate, and iron, the data these experts looked at indicated that pollen has nutritional value comparable to dry beans, peas, and lentils, and that it has even higher levels of calcium and magnesium than legumes. Bee pollen is especially rich in vitamins and contains more pantothenic acid than beef, eggs, cauliflower, potatoes, or tomatoes. The nicotinic acid content of blended pollen reaches a high in the summer and approaches that of beef and beef liver. This pollen has more nicotinic acid than dried beans and peas, only surpassing wheat bran and yeast. In terms of ascorbic acid content, pollen is on par with fresh lettuce, endive, boiling potatoes, and canned tomatoes. The only plant material with more riboflavin is yeast. As a result, pollen has a riboflavin content similar to skim milk. One of the reasons pollen is employed as a medicinal preparation is due to its high vitamin B12 content **(Tull, 1987) [5].** Pollen has little vitamin E and D, just like other plant matter.

Pollen as medicine

In Germany, the Federal Board of Health has approved the use of pollen as medicine, according to "**Bundesanzeiger" (No. 11 of 17 January 1991**). A variety of flowering plant pollen, either taken as raw pollen or as a preparation in the proper dosage, can be used as an invigorating tonic for an inability to eat or general lethargy. Giving out pollen has been reported to be beneficial in situations of chronic prostatitis. **Denis, 1966 [6].** The rye pollen extract "Cernitol," which is utilised as an anticongestive in urology, is one example of this. The chemical that suppresses the production of prostaglandin and leukotrienes is thought to be present in the extract's liposoluble fraction, according to experimental findings, even if the exact mechanism of action is yet unknown. In cases of benign prostatic hyperplasia, pollen can be soothing, antiproliferative, anticongestive, and antiphlogistic.

Georgieva and Vasilev (1971) [7] claim that a pollen treatment for bleeding stomach ulcers was successfully tested on 40 patients who got a daily dose of 250 mg of pollen twice a day. Because pollen in a pellet is combined with a bee's endogenic components, as opposed to pollen collected by humans, only bee pollen was used in these treatments. Peng and colleagues discovered that eating pollen can increase a person's ability to acclimatise to high altitudes with little oxygen.

Gynaecological carcinomata patients also had radiation therapy and were put on a pollen diet. Bee pollen has also been administered orally to patients who suffer from pollen allergies. Depending on the oral immunotherapy (desensitisation) situation, pollen may have an immunogenic effect.

Pollen as nutritive value

Pollen's nutritional value for living things has never been in doubt, but its medical potency is still up for debate. In addition to bees, several other insect species use pollen as a substitute for food, such as predatory mites. The kind of pollen that Phytoseiidae, or herbivorous mites, eat influences the food's nutritional value. For best results, a bee should be fed a variety of pollen. Pollen gathered by bees has a higher value than pollen gathered by humans. The amount of soluble proteins and amino acids, especially the nitrogen concentration, seems to be the determining factor. Additionally, nutritional content is higher in pollen from entomophilous plants than anemophilous plants. Compared to pollen that is manually obtained, bee pollen has superior antibacterial effects. This may help to partially explain the antibacterial effect of honey in connection with skin grafting surgery that has recently been reported. In this context, it is important to note that commercially available pollen preparations contain organically altered pollen that appears to have undergone in vitro simulations of enzymatic activities that frequently take place inside bee hives as well. The nutritional differences between pollen that is gathered by bees and pollen that is later processed and kept in combs serve as another illustration of this. Only a few clinical and experimental investigations have attempted to quantify the nutritional value of pollen, however it appears that the protein, carbohydrate, and fat contents can vary according on the species, from 5% to 30%, 10% to 40%, and 1% to 5%, respectively.

Pollen may include carbs and lipids that aid with digestion. It's the same with eating protein. The range of fully absorbed and transformed protein needed per day for a 70 kg person is 20 to 26.5 g, or 28.5% to 38% protein with a net protein utilisation (NPU) of 70% (**Tracey, 1989) [8].** This requirement can be met by ingesting 90 g of pollen everyday without the need for additional protein sources. Pollen should be taken into consideration as a potential food supplement because it is noteworthy that at least some of a man's protein requirements can be satisfied by pollen **(Stanley and Linskens, 1984).** Unless we are dealing with a zealous beekeeper, this scenario does not seem particularly likely.

Pollen as supplementary foodstuff

Pollen could be used as a "alimentary miracle" in a variety of situations, including to increase hunger, during weight-loss treatments, for the treatment of dyspepsia and neurasthenia, brain injury, and growth disruption. However, either no clinical studies exist to support these applications, or those that do exist were published in difficult-to-access literature.It must be emphasised that pollen cannot be likened to "drug-taking." The numerous components that make up pollen, each of which can have a different mode of action depending on the time of year, how it was collected, and the type of pollen, are far more responsible for its particular effects. Keeping this in view a study was conducted to explore the biochemical contents of weed aeroallergens (Pollen Grains) were performed at Bikaner district of Rajasthan.

II. MATERIAL AND METHODS

2.1 POLLEN COLLECTION

The fresh polliniferous material of selected plant species, *Aerva tomentosa, Amaranthus spinosus, Chenopodium murale, Parthenium hysterophorus and Xanthium strumarium* was collected in bulk during the pollen season from the study area. To procure pollen, dried flowers were crushed gently and the pollen thus released were sieved through 100, 200 and 300 mesh/cm^{2}sieves.

Observations were recorded for moisture, crude protein, ether extract, crude fiber, total ash, nitrogen free extract, carbohydrate, acid soluble ash, calcium and phosphorus from the selected allergnic pollen grains.

With the help of SDS-PAGE technique protein profiles of all selected pollen antigens were studied. The pollen sample were analyzed for proximate constituents by procedure of **AOAC (1995) [9]** and the method of **Talpatra e/ *al.* (1940) [10]** was adopted for the determination of calcium and phosphorus.

III. Results and Discussion

A summary of the nutritional content of the selected types of pollen is present in **Table 2** and **Fig. 1 to 5.**

Table 2: Biochemical Analysis (%DM Basis):

Content	*Aerva tomentosa*	*Amaranthus spinosus*	*Chenopodium murale*	*Parthenium hysterophorus*	*Xanthium strumarium*
Moisture	2.39	2.09	7.00	8.00	2.30
Crude Protein	9.53	20.12	21.57	17.23	15.40
Ether Extract	3.74	3.90	3.00	3.85	4.00
Crude Fibre	32.20	17.20	18.67	21.96	24.30
Total Ash	11.41	13.18	23.50	12.00	9.80
Nitrogen Free Extract	43.12	45.60	41.26	44.96	46.50
Carbohydrate	75.32	62.80	59.93	66.92	70.80
Calcium	3.85	4.32	4.70	2.15	3.75
Phosphorus	1.50	1.53	1.84	1.02	1.45

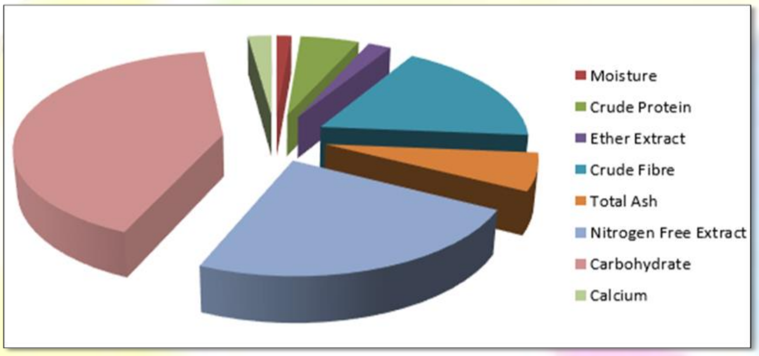

Fig 1. Chemical contents of Aerva tomentosa

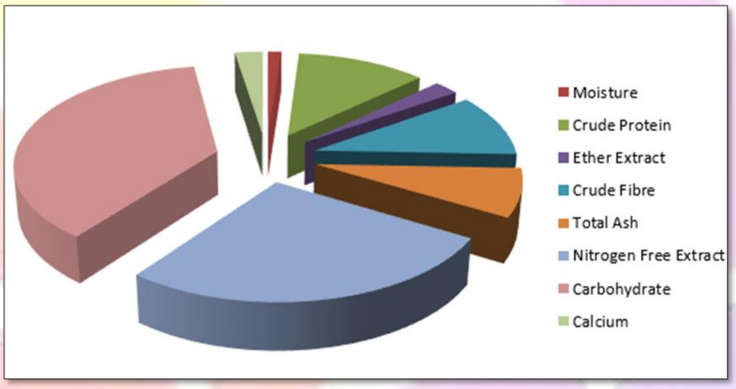

Fig 2. Chemical contents of Amaranthus spinosus

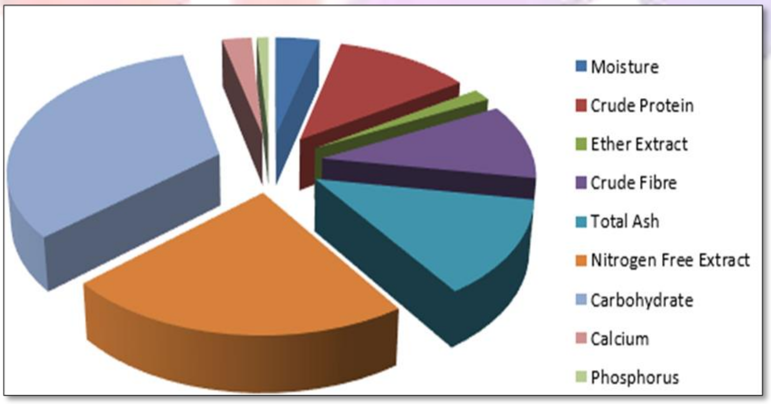

Fig 3. Chemical contents of Chenopodium murale

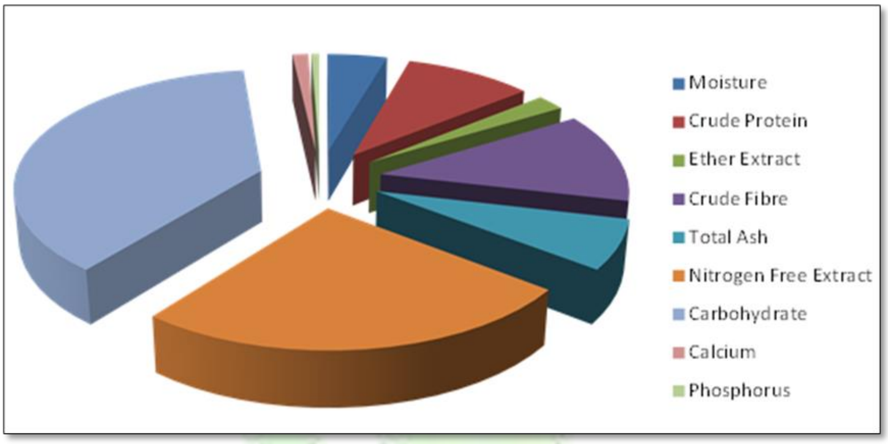

Fig 4. Chemical contents of Parthenium hysterophorus

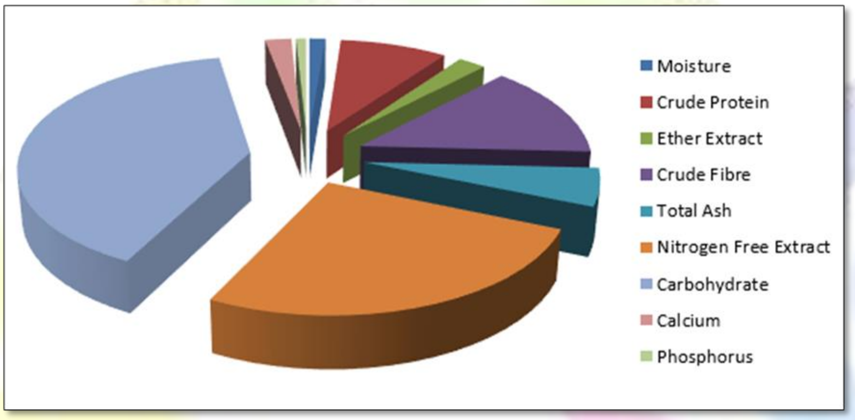

Fig 5. Chemical contents of Xanthium strumarium

The water content of moisture of all pollen grains was in agreement with the few values in the literature i.e. less than 20% **(Roulston and Cane, 2000) [11].**The water content or moisture was maximum in the pollen grains of *Parthenium hysterophorus*(8%). It was followed by *Chenopodium murale*(7%). *Aerva tomentosa* (2.39%), *Xanthium strumarium* (2.30%) and *Amaranthus spinosus*(2.09%) pollen grains showed less amount of moisture. The crude protein content of pollen is considered as a direct and reliable measure of its nutritional value. Pollen protein contents ranging widely from 12 % to 61 % **(Roulston *et aI.* , 2000) [12].**

Crude protein was high in pollen grains of *Chenopodium murale* (21.57%) as compare to *Amaranthus spinosus* (20.12%), *Parthenium hysterophorus* (17.23%) and *Xanthium strumarium* (15.40%). Pollen grains of *Aerva tomentosa* (9.53%) showed low crude protein contents.

Roulston and Buchmann (2000) [13] observed high level of crude protein (46.7%) in pollen grains of *Aloe ferox* and **Human and Nicolson (2006) [14]** found 50.8% of crude protein in fresh pollen of *Aloe greatheadii.*

Ether extract content of pollen grains comprised only a small amount **(Manning,2001) [15] .**In present study ether extract content of pollen grains of selected plant species did not show much variation. It was higher in *Xanthium strumarium* (4%) and followed by *Amaranthus spinosus* (3.90%), *Parthenium hysterophorus* (3.85%) and *Aerva tomentosa* (3.74%).The minimum ether extract content was observed in *Chenopodium murale* (3%).As well as crude fibre was concerned, it contributed highest in *Aerva tomentosa* (32.20%) and lowest in *Amaranthus spinosus*(17.20%).

In present study total ash content in selected pollen grains was significantly high ranges between 23.50 % to 9.80%. **Bhojak *et al.* (2005)[16]** reported that the ash contents in two different samples (a and b) of *Prosopis julifiora* pollen grains were 12.4% for sample a and 15.4% for sample b.

Nitrogen free extract and carbohydrate varies widely in pollen grains. **Todd and Breathrick (1942) [17]** recorded value from 1 % to 37 % of total dry mass in hand collected pollen. In present investigation NFE values were found maximum for the pollen grains of *Xanthium strumarium* (46.50%). It was very close to the values of *Amaranthus spinosus* (45.60%) and *Parthenium hysterophorus* (44.96%) .NFE values were lowest in pollen grains of *Aerva tomentosa* (43.12%) and *Chenopodium murale* (41.26%).Carbohydrate values were found maximum for the pollen grains of *Aerva tomentosa* (75.32%) during the present study

.It was followed by *Xanthium strumarium* (70.80%), *Parthenium hysterophorus* (66.92%) and *Amaranthus spinosus*(62.80%). Carbohydrate values were lowest in pollen grains of *Chenopodium murale*(59.93%).

High contents of carbohydrate indicate the nutritive value of pollen grains of all selected plant species. **Mandal *et al*. (1993) [18]**found that carbohydrate constitute the major dry matter fractions in both *{Madhuca indica* and *Spathodea campanulata }* pollen types with highest amount in *Madhuca indica* (25.37%). Calcium and phosphorus were found in lesser quantity in all selected pollen grains. The remarkably calcium content (4.70%) was present in *Chenopodium murale* pollen. The lowest quantity of calcium was present in *Partheniumhy sterophorus* (2.15%). The phosphorus content was found in low value ranging 1.84% to 1.02% in all selected pollen grains. **Somerville and Nicol (2002) [19]** studied the mineral content of honeybee collected pollen from 34 floral species. They found phosphorus and calcium contributed 4600 mg/kg and 1146 mg/kg respectively.

12% SDS-PAGE of soluble protein of *Aerva tomentosa* pollen grains revealed two major protein bands between the molecular weight ranges of 98 — 201 kDa. These bands were designated as Ati (98.4kDa) and Atm (200.9kDa) . **Mondal *et al.*(2007)[20]** find out nine prominent protein bands of *Ailanthus excels* on12%SDS-PAGE,which were lying within a short molecular weight range of 42.7 kDa to 97.4kDa. *Amaranthus spinosus* pollen grains showed four major protein bands between molecular weight range of 62—205kDa,these were As] (61.5kDa),As2(98.4kDa),As3(110.7kDa) and As4(205kDa).Five major protein bands were reported in between the range of 62-205 kDa for *Chenopodium murale*pollen grains with the molecular weight of C>i(61.5kDa), Cm2(94.3kDa), Cm3(143.5kDa), Ai4(188.6kDa) and C 5 (205kDa). Five protein bands were also showed by *Parthenium hysterophorus* with molecular weight range of 66 — 225 kDa. The molecular weight values were Ph (65.6 kDa), Ph2 (114.8 kDa), Ph3 (135.3kDa), Ph4 (180.4 kDa) and Ph 5 (225.5 kDa).

Killian and McMichael (2004) [21] detected fourteen protein bands of mesquite *{Prosopis julifiora}* in SDS-PAGE. The molecular weights of these bands range from 11 to 99 kDa.

Some indistinct protein bands have also been detected inbetween major protein bands in all selected types of pollen antigen.Maximum number (5) of protein bands were observed in case of *Chenopodium murale* and *Parthenium hysterophorus* .It was followed by *Amaranthus spinosus* (4).Two bands were reported for *Aerva tomentosa* and *Xanthium strumarium.*On the basis of molecular weight it was observed that *Parthenium hysterophorus* (225.5 kDa) showed first position in row of five pollen grains in SDS-PAGE analysis. Lowest molecular weights values were recorded for *Amaranthus spinosus* and *Chenopodium murale* (d1.5kDa.In present study *Parthenium hysterophorus* showed wide strange of molecular weight (65.6 to 225.5 kDa). Other pollen samples produced their bands mostly in the range of 66 — 205kDa.

IV. Conclusion

Nutritivelly, pollen grains of all selected plant species are good source of nutrition. *Chenopodium murale* pollen are good source of protein and pollen grains of *Aerva tomentosa* are rich in carbohydrate contents. These pollen grains can be a good resource of food for honey bees and further for human beings if consumed as honey. Calcium and phosphorus are also present as mineral contents.
SDS-PAGE resolved pollen extract of *Parthenium hysterophorus* in to five distinct protein bands ranging from 66 — 225 kDa which is highest among the selected pollen extracts. On the other hand *Aerva tomentosa* showed two bands but it was observed to produce highest skin test positivity. It means higher number of distinct protein bands does not indicate the high errate of positive skin tests. *Chenopodium murale* showed maximum crude protein contents and it showed maximum five distinct protein bands with molecular weight 62—205 kDa. Similarly *Aerva tomentosa* showed minimum crude protein contents and resolved two protein bands on SDS-PAGE. In can be concluded that higher amount of crude protein contents of pollen grains indicate the higher number of distinct bands. Protein bands of molecular weight ranges in between 62—225kDa are reported in all cases.

Biochemical studies should be made for pollen grains of entomo / Amphiphilous plant species to determine the nutritive value of pollen grains to test the quality of honey and number of protein bands to find out the appropriate protein or allergen responsible for respiratory allergy.

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