SOME OF WEATHER PHENOMENA IN THE MOIST AIR NEAR SOIL SURFACE AT ISMAILIA DISTRICT, EGYPT

El-Raires S.A.A.*, Aboul Defan T.A.*, El-SiSi S.M.* and Taha H.A.A.**
*Soil, Water and Environ. Res. Instit., Agric. Res.Cent. (ARC), Giza - Egypt.
**Plant Protection Res Instit. Aagric. Rec. Cent. (ARC) Dokki , Giza Egypt

ABSTRACT

The research was conducted at Ismailia Agricultural Research Station, Agric. Res. Central (ARC) to study some of weather phenomena in moist air near soil surface. To achieve this goal, the phenomena measurements of air temperature **(T, ^{o}C),** vapor pressure **(VP, kPa)** were recorded, which the values of relative humidity **(RH %)** and saturation vapor pressure **(SVP, kPa)** were calculated, and dew point temperature **(TDP, ^{o}C)** were recorded as well as may calculate from the weather station of Ismailia Agric. Res. Station.

Air temperature **(T, ^{o}C)** had started to be hot from 7a.m. and the peak at 3p.m. This differed from month to another through the average day hourly (h), during the twelve months of the year. Meanwhile, along the 24 day's hours relative humidity **(RH, %)** had depressing manner opposite to air temperature depressing trend. However, relative humidity **(RH, %)** showed depressing with increasing of air temperature **(T, ^{o}C)**.

Saturated vapor pressure **(SVP, kPa)** was high at August and low at December, January and February. This trend was related to air temperature. Vapor pressure **(VP,kPa)** were low and the depression more or less at 3 p.m. for all months, where at very low at January and February and relatively high at July and August.

The relations between both air temperature **(T, ^{o}C)** and dew point temperature **(TDP, ^{o}C)**, along the months of **(T- air, ^{o}C)** values were more than the corresponding values of **(TDP, ^{o}C)**. The distance between the rise in **(T, ^{o}C)** and the depression in **(TDP, ^{o}C)** was as far as at ~ 3 p.m. and were more obvious during the months of June, July and August.

The relations between all of **SVP (kPa)**, **VP ,(kPa), T-air (^{o}C), RH (%) and TDP (^{o}C)** can be represented by mathematical formals in five equations, where they were (1) polynomial, (2) logarithmic, (3) exponential, (4) power and (5) linear.

The better relation of the studied weather formula was polynomial compared with other equations, whereas the regression coefficient (r) for polynomial equation at SVP, VP, T, RH, and TDP were 0.83, 0.80, 0.81, 0.77, 0.83, respectively, and the best regression coefficient were for SVP and TDP.

INTRODUCTION

Jon et al. (2014) summarized that; the microclimate is defined as the climate near the ground. It consists of the lowest 20 to 30 feet of the atmosphere above the soil surface; or anything covering it; and foot or two top of soil. The microclimate is best characterized as a region with rapid changes in air temperature, wind speed, humidity and/or dew point temperature occurring over short distances and/or in short time periods. It is also a region of air and surface temperature extremes. Surface characteristics usually determine weather conditions in the microclimate, especially when wind speed is low. They continued , understanding air temperature (T-air, $^{\circ}$C) inversions requires a basic understanding of numerous energy transfers that cause the Earth's surface temperature to increase or decrease and microclimate air and soil temperature to change.

Howard (2016) realized that, the air condensation is the process by which water vapor in the air is changed into liquid water. He continued, air condensation is crucial to the water cycle because it is responsible for the formation of clouds. These clouds perhaps lead to produce precipitation, which is the primary route for water to return to the earth's surface within the water cycle. Condensation is the opposite of evaporation. In another definition, air condensation is the accumulation of water vapor changing to liquid water onto a surface.

Relative humidity can be defined as the ratio between how much water vapor is in the air and the maximum amount of water that can be held in the air. **Vaisala (2013)** stated that it is measure as the ratio of the water vapor pressure "Pw" to the saturation water vapor pressure "Pws"(over water) at the gas temperature: RH = [(Pw) / (Pws)] *x*100%. The total pressure does not enter the definition. Above 100°C the same definition is valid. But as the saturation vapor pressure is greater than 1.013 kPa (normal ambient pressure) the RH can't reach 100% in an unpressurised system. Below 0°C the definition is also valid. Here 100%RH is also impossible because condensation will occur at a lower humidity than 100%. **Mark (2005)** denoted that, Relative humidity is commonly defined in a way, which the ratio of the "actual water vapor pressure (*e*)" to "the equilibrium vapor pressure over a plane of water (*es*)" (often called the "Saturation Vapor Pressure") , **RH = 100 *x* (*e* / *es*)**.

All gases can be "forced" to become liquid (condense) by the process of cooling. For conditions on the earth, only one gas can be condensed by cooling, water vapor. The temperature at which such condensation would occur is called the **Dew Point Temperature "TDP"**.

As **NML and Arch. (2012)**, dew is the condensation of water vapor on a surface whose temperature is at or below the dew-point of the air. Dew appears as innumerable small water droplets less than a millimeter in diameter. The most common natural surface upon which dew forms is vegetation, and in particular, grass. Dew forms on surfaces that have a reduced temperature by radiation cooling to below the dew-point of the air in contact with it. Dew point is defined as the temperature at which the air, when cooled, will become saturated. Below the dew point, liquid water will begin to condense on solid surfaces (such as blades of grass) or around solid particles in the atmosphere (such as dust or salt), forming clouds or fog.

Vaisala (2013) defined "Dew point temperature" (°C or °F) is the temperature where condensation begins, or where the relative humidity would be 100% if the air was cooled. For example, take a day in late summer when the air temperature reaches 18 °C with a dew point of 8 °C. Late in the afternoon as the sun sets, the air temperature begins to fall, but the dew point remains around 8 °C. However, the air temperature is measured at 1 meter above the ground and, under clear skies; the temperature of some objects may fall significantly lower, due to loss of heat by radiation. Once the temperature of the object has fallen below the dew point, water vapor begins to condense on to it in the form of dew.

Mark (2005) reported that, there is a relationship between the dew point and relative humidity. A high relative humidity means that the dew point is near the current air temperature. Therefore, a relative humidity of 100% indicates that the dew point is equal to the current temperature. The relative humidity (RH %) and the dew point temperature (TDP, $^{\circ}$C) are two widely used indicators of the amount of moisture in air. They decided that, the exact conversion from RH to TDP, as well as highly accurate approximations, are too complex to be done easily without the help of a calculator or computer. However, they found a very simple rule to be quite useful for approximating the conversion for moist air (RH > 50%), which does not appear to be widely known by the meteorological community: DPT decreases by about 1°C for every 5% decrease in RH (starting at $DPT = t$, the dry-bulb temperature, when RH = 100%): $\mathbf{RH \approx 100 - 5(T - TDP)}$ **,** where T and DPT in degrees Celsius ($^{\circ}$C) and RH is in percent.

This work aims to study some weather phenomena in moist air near soil surface. The studied phenomena were air temperature **(T, ^{o}C)**, vapor pressure **(VP, kPa)**, relative humidity **(RH %)**, saturation vapor pressure **(SVP, kPa)**, and dew point temperature **(TDP, ^{o}C)**.

MATERIALS AND METHODS

The present study was conducted at Ismailia Agriculture Research Station (IARS), Agriculture Research Center (ARC). The abscissas of location of this study were Latitude 30˚ 35̍ 30˝ N and longitude 32˚ 14̍ 50˝ E. The weather equipment is CR10 measurement and control module from **CAMPBELL SCIENTIFIV INC 1986**. The station recorded Tair (^{o}C), VP (kPa), while RH (%) and SVP (kPa) were calculated manually and TDP (^{o}C) were recorded as well as may calculate. This search aims to study some of weather phenomena in moist air near a sandy soil of the soil surface of (IARS). The following are the equations were considered.

Equation consideration.

1) ***Air temperatures (T, °C)*** were recorded directly by weather station**.**

2) Vapor pressure (VP,ea, kPa) were recorded directly by weather station

3) ***Saturation vapor pressure (SVP, ed, kPa)*** were calculated according to**:**

*** Bosen (1960)**

SVP (ea) = $3.38639\,[(0.00738T+0.8072)^{8} - 0.000019\,(1.8T + 48)+0.001316]$ →E. (1)

*** Tetens (1930) (*C.F*. Allen.et al , 1998) and Murray (1967)** for water surface.

$$SVP(ea)kPa = \exp\left[\frac{16.78 \times T - 116.9}{T + 373.3}\right] \rightarrow E.2$$

To calculate *the saturation vapor pressure (SVP, kPa)* at air temperature (T, °C) as the following:

$$SVP = 0.06108 \exp\left(\frac{17.27T}{T + 273.3}\right) \rightarrow E.3$$

4) Relative humidity (RH %) were calculation according to **(FAO 1998)**

$$RH = (\frac{ed}{ea})x100 = (\frac{VP}{SVP})x100 \quad \rightarrow E \cdot (4)$$

5) Dew point temperature (TDP, °C) were calculated according to **Erpenbeck (1981)**

$$TDP = \frac{116.9 + 273.3 \ln VP}{16.78 - \ln VP} \quad \rightarrow \textbf{E. 5}$$

The formulas of the used mathematically equation:

1) Polynomial: $P(x) = a_n x^n + a_{n-1} x^{n-1} + \cdots + a_2 x^2 + a_1 x + a$

2) Exponential: $Y = x^b$

3) Logarithm: $Y = \log b^{x}$

4) Power: $Y = 10^x$

5) Linear: $Y = a + bx$

The readings of the values of the studied phenomena had been measured by weather station in Ismailia Research Station. They were represented the phenomena of Air Temperature **(T, °C)**, Relative Humidity

(RH %), Vapor Pressure **(VP, kPa)**, Saturation Vapor Pressure **(SVP, kPa),** and Temperature of Dew Point **(TDP,°C)**. While **(T,°C)** and **(VP, kPa)** were measured immediately by the weather station, all of **(RH %)**, **(SVP, kPa)**, and **(TDP,°C)** were calculated on the base of some special theoretical mathematically considerations (above equations), then exhibited by the same station. The readings of the phenomena under study were recorded as an average of the 24 hours of the day for the twelve months.

RESULTS AND DISCUSSION

(1) Air Temperature (T-air, °C):

Fig (1) showed the general trend of increases and decreases of (T-air, °C) during 24 daily hours. Whereas, (T-air, °C) had started to be hot from 7 a.m., and then continued to increase until its peak at 4 p.m. The values of temperature centigrade (°C) showed difference between their values during the 24 daily hours, from month to another through the twelve months.

Table (1) and Fig (2) explained that the average, minimum and maximum of air temperatures (°C) along of the months. They were depressed beginning from September till the maximum depressed at January. While, they were start to increase from May till the maximum in August.

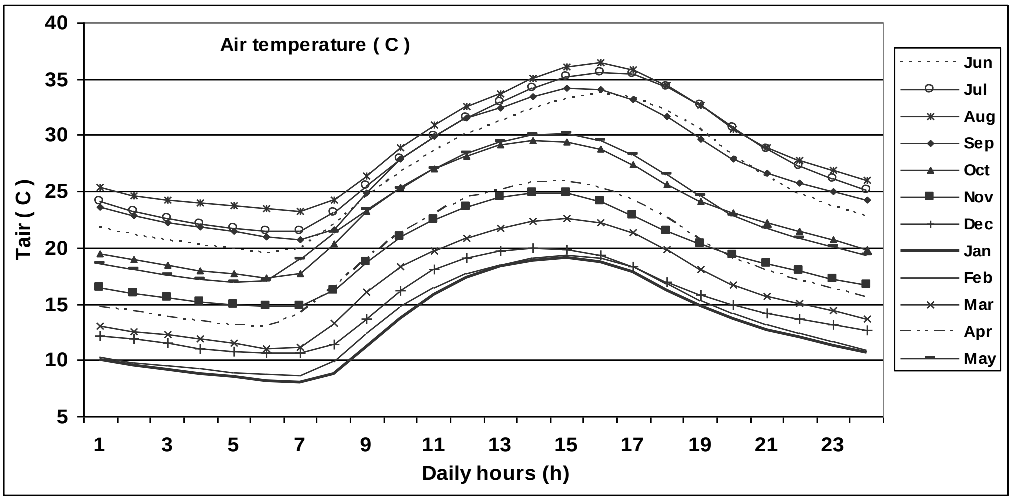
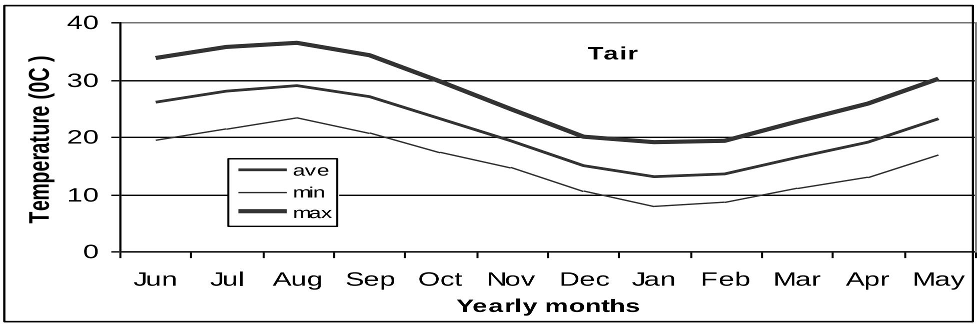


Fig (1): Average air temperature (°C) values of daily hours (h) average of the 12 months.

Table (1): Average, minimum and maximum of air temperature (T, °C) values for the 12 months.

Months	Tair (°C)		
	Average	Minimum	Maximum
Jun	26.10	19.53	33.65
Jul	28.06	21.45	35.62
Aug	29.01	23.29	36.44
Sep	27.00	20.71	34.21
Oct	23.06	17.31	29.60
Nov	19.28	14.76	24.89
Dec	14.83	10.61	20.00
Jan	13.06	8.05	19.08
Feb	13.56	8.65	19.30
Mar	16.49	11.08	22.56
Apr	18.99	12.92	25.88
May	23.06	16.91	30.14



Fig(2): Average of air-T (°C) values of the 24 months.

These trends of T-air **(T,°C)** can be expressed by using different statically mathematically formulas of polynomial formula , which was the best one (r = 0.818) followed by logarithmic formula (r = 0.694) than those submitted by the other formulas , as shown (Table 2).

Later in the same context, Fig (16) graphically expressed the general trends of **(Tair °C)**, throughout all the months of the year, by using the statically mathematically formulas of polynomial, logarithmic, exponential, power and linear.

Table(2): Different statistical regression equations and their coefficients of (Tair,°C).

T- air (°C)			
Statistical equations	**Equations**	**r**	**R^2**
Polynomial	$Y= 0.2484 X^2 - 4.2938x + 35.498$	0.818	0.664
Logarithm	$Y= - 5.3386 \ln(x) + 29.935$	0.694	0.486
Exponential	$Y= 28.034 e^{-0.0498x}$	0.623	0.388
Power	$Y= 30.921 x^{-0.2532}$	0.663	0.440
Linear	$Y= - 1.06646x + 27.963$	0.663	0.440

(2) Vapour pressure (VP, kPa):

Fig (3) showed that, the vapor pressure **(VP,kPa)** started to depress between 10 a.m., while the highest depression were noticed at 3 p.m. These trends were observed in all months of year. Generally, the values of vapor pressure **(VP,kPa)** were very low at January and February and relatively high at July and Aug. (Table 3).

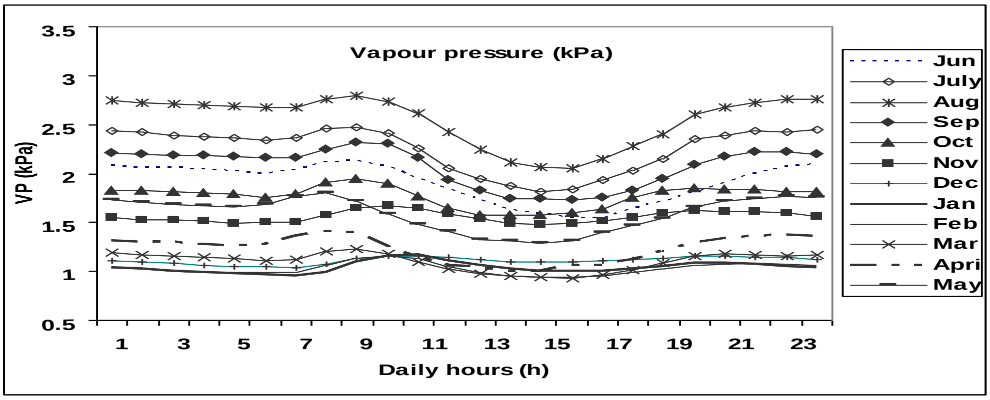


Fig (3): Average vapor pressure (VP,kPa) values of the 24 daily hours along the 12 months.

Table (3): Average, minimum and maximum of air temperature (VP ,kPa) values for the 12 months.

Months	VP (kPa)		
	Average	Minimum	Maximum
Jun	1.90	1.54	2.13
Jul	2.25	1.82	2.47
Aug	2.54	2.05	2.80
Sep	2.07	1.74	2.32
Oct	1.77	1.57	1.95
Nov	1.56	1.48	1.67
Dec	1.11	1.04	1.16
Jan	1.04	0.96	1.17
Feb	1.03	0.94	1.16
Mar	1.10	0.93	1.23
Apr	1.23	1.00	1.40
May	1.59	1.29	1.80

Fig (4) showed the trend of the average, minimum and maximum of the saturated vapor pressure **(VP, kPa**) along the months. These trends supported the general trend through the months of years mentioned above, but all the curves of the figure were as nearest as them. The expression by using the polynomial formula for (VP kPa) was the best one (r = 0.802) followed by linear formula (r = 0.756) to represent the vapor pressure (VP, kPa) than those preceded by the other formulas, (Table 4) , and the graph will be represented later during the discussion of other items.

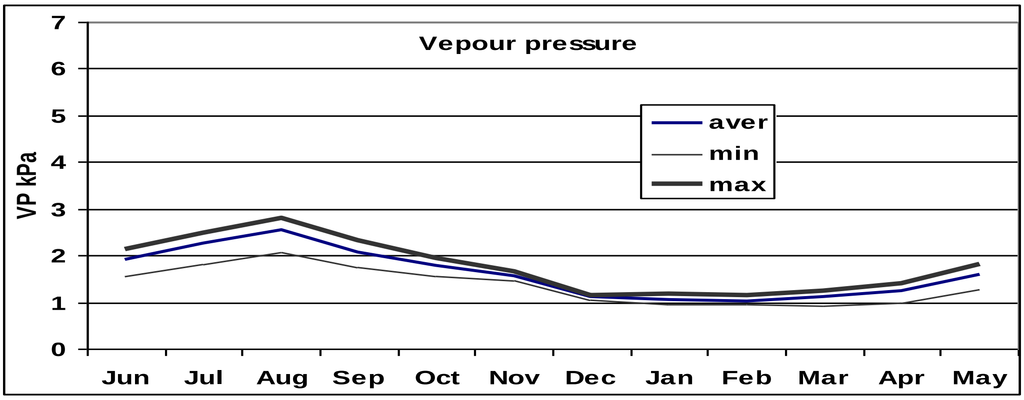


Fig (4): Average vapor pressure (VP, kPa) values of the 12 months.

Table (4) : Different statistical regression equations and their coefficients of (VP, kPa).

VP, kPa			
Statistical equations	**Equations**	**r**	**R^2**
Polynomial	Y= 0.0137 X2 – 0.2848x + 2.7084	0.802	0.643
Logarithm	Y= - 0.4891 ln (x) + 2.4149	0.719	0.516
Exponential	$Y= 2.3311\ e^{-0.0651x}$	0.732	0.537
Power	$Y= 2.5301\ x^{-0.3033}$	0.716	0.512
Linear	Y= - 0.1055x + 2.2924	0.756	0.557

(3) Saturation Vapor Pressure (SVP, kPa):

Fig (5) showed that the saturated vapor pressure **(SVP, kPa)** started to increase at 7 a.m. and then take the increase until reach to the maximum increase at 5 p.m. On the other hand, saturated vapor pressure **(SVP, kPa)** were high in August and low in December, January and February. These trends were related to air temperature (Table 1).

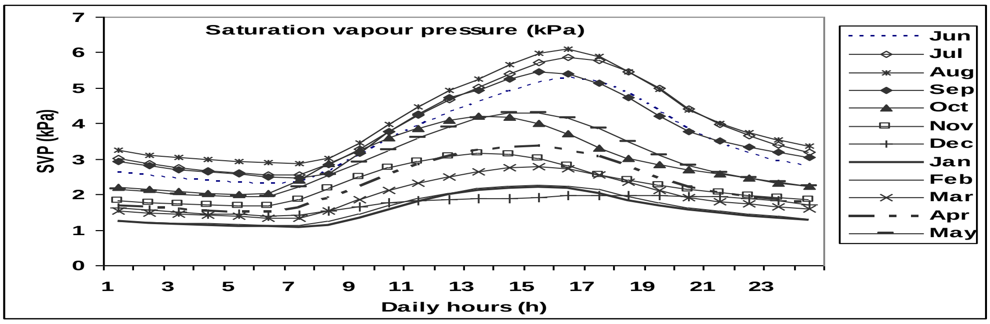


Fig (5): Average SVP (kPa) values of the 24 daily hours along the 12 months.

Table (5) and Fig (6) represented the general trends of the average, minimum and maximum of the saturated vapor pressure **(SVP, kPa)** along the months.

Table (5) : Average, minimum and maximum saturation of SVP (kPa) values for the 12 months.

Manths	SVP (kPa)		
	Average	Minimum	Maximum
Jun	3.54	2.29	5.28
Jul	3.95	2.57	5.86
Aug	4.14	2.87	6.11
Sep	3.72	2.46	5.46
Oct	2.93	1.99	4.21
Nov	2.30	1.69	3.16
Dec	1.75	1.41	1.97
Jan	1.55	1.08	2.21
Feb	1.62	1.14	2.28
Mar	1.95	1.34	2.78
Apr	2.30	1.50	3.38
May	2.93	1.93	4.31

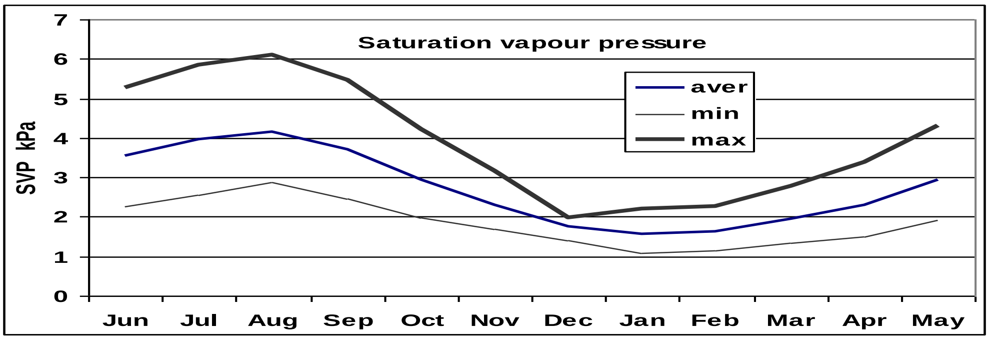


Fig (6): Average SVP (kPa) values along the 12 months.

These trends were in coinciding with the trends mentioned above. These trends can be expressed by using the polynomial formula for (SVP kPa) was the best one (r = 0.831) followed by logarithmic formula (r = 0.724) to represent the climate parameters with time than those preceded by the other formulas, (Table 6).

Table (6) : Different statistical regression equations and their coefficients of (SVP, kPa).

SVP, kPa			
Statistical equations	**Equations**	**R**	**R^2**
Polynomial	$Y= 0.039 X^2 - 0.6882x + 5.0854$	0.831	0.692
Logarithm	$Y= - 0.9022 \ln(x) + 4.225$	0.724	0.524
Exponential	$Y= 3.9175 e^{-0.0648x}$	0.654	0.428
Power	$Y= 4.4338 x^{-0.3272}$	0.692	0.479
Linear	$Y= - 0.1818x + 3.9039$	0.696	0.485

Relations between (T-air, ^{o}C), (SVP, kPa) and (VP, kPa):

As shown in Fig (7), the values of **(SVP, kPa)** were more related with **(T-air, ^{o}C)** than **(VP, kPa)**. While , **(VP, kPa)** showed decreasing with increasing **(T-air, ^{o}C)** , the curves of **(SVP, kPa)** had similar trends as the curves of **(T- air, ^{o}C)** and their values had been elevated with increasing air temperature. These trends were similar along the 24 daily hours for the twelve months.

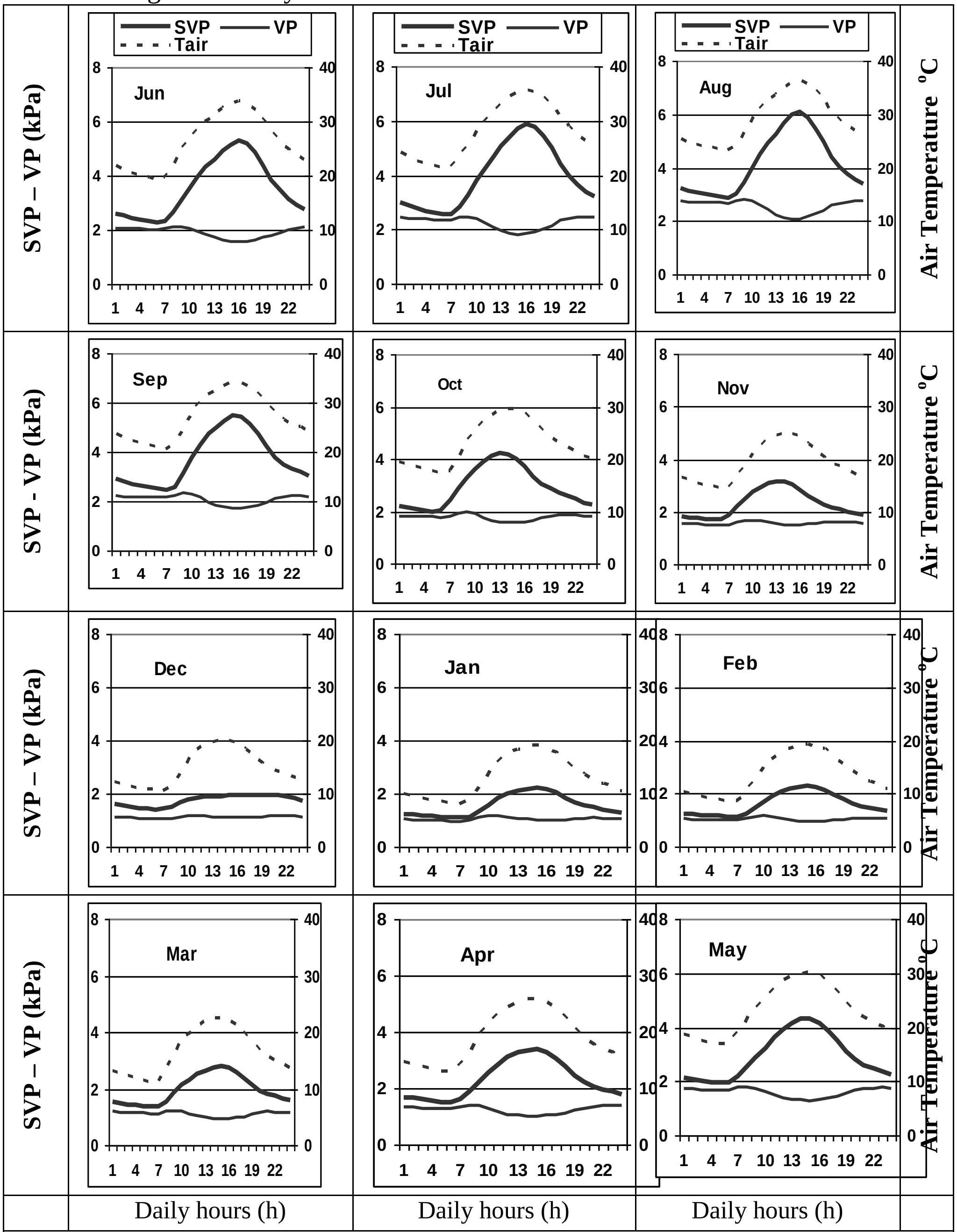


Fig (7) The relationship between SVP (KPa) and air temperature (T) (^{o}C)

The general trends of (**SVP, kPa), (VP, kPa)** in relations with **(T- air, ^{o}C)**, throughout all the months of the year, were expressed by using the statically mathematically formulas of polynomial, logarithmic, power, exponential and linear as shown in Fig (8). These trends showed that, the expression by using the polynomial formula was the best one to represent the relations of the climate parameters of **(SVP, kPa)** & **(VP, kPa)** with **(T- air, ^{o}C)** as than those preceded by the other formulas.

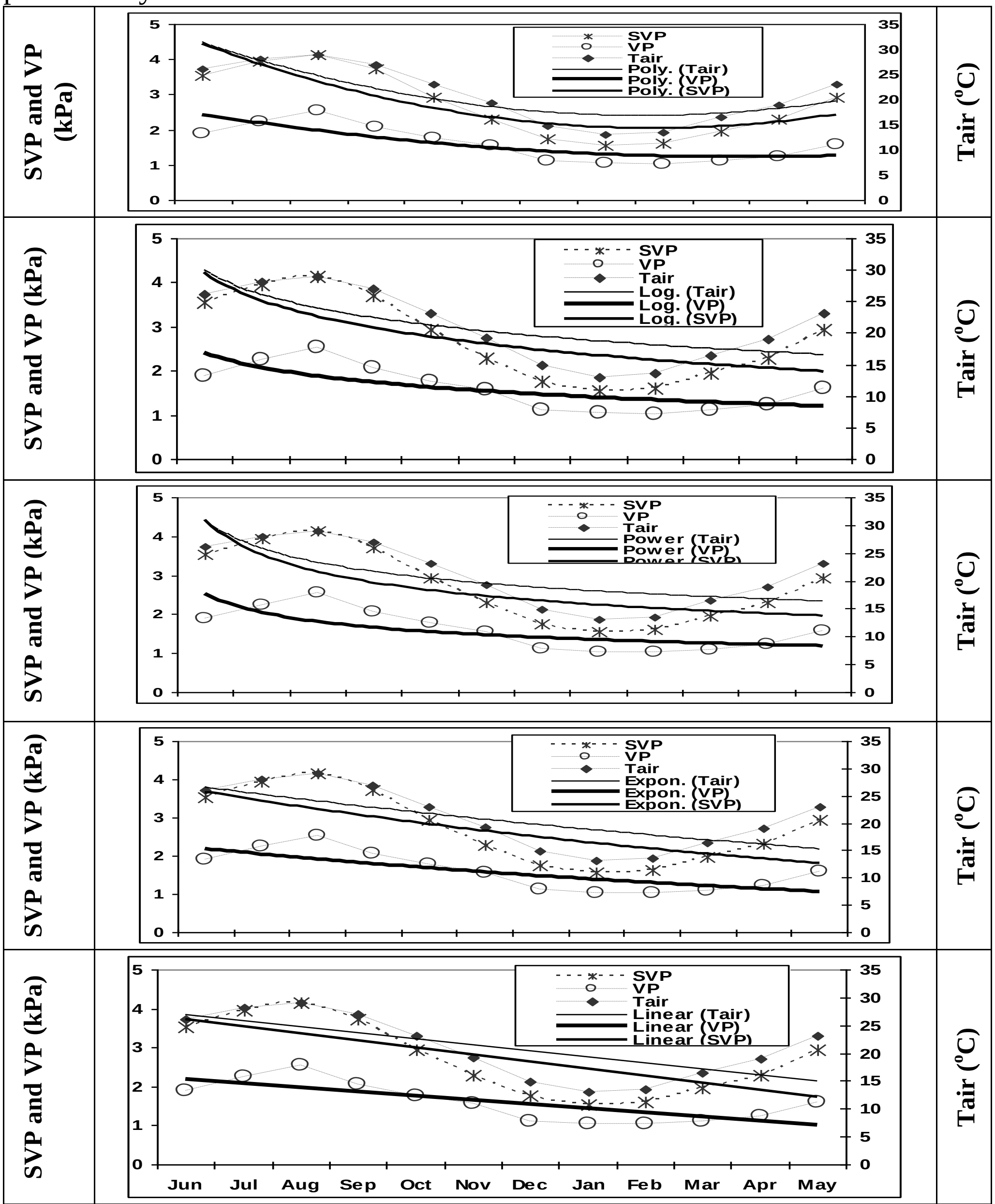


Fig (8): Tair, VP and SVP with the different equations

(4) Relative humidity (RH, %):

Relative humidity **(RH, %)** had a depressing manner oppsite to trends of air temperature depressing along the 24 daily hours. Fig (9) showed that, **(RH, %)** started to depress from 7a.m. till the maximum depression at 3p.m. through the twelve months. Table (7) and Fig (10) represented the same trend for the average, minimum and maximum of (**RH, %)** through the months.

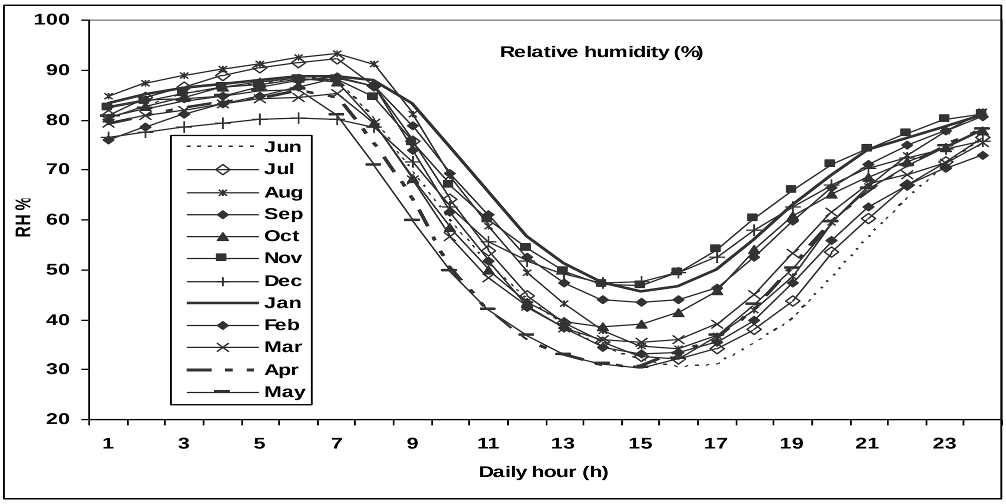


fig (9) : Average of relative humidity (RH, %) values for the 12 months.

Table (7) : (RH, %) values of the 24 daily hours along the 12 months.

Months	RH (%)		
	Average	Minimum	Maximum
Jun	60.70	30.40	88.18
Jul	63.50	32.22	92.25
Aug	67.22	34.15	93.19
Sep	61.90	33.08	88.35
Oct	65.57	38.50	88.35
Nov	70.88	46.79	88.20
Dec	66.65	47.42	80.41
Jan	71.36	45.52	88.77
Feb	68.99	43.48	88.55
Mar	62.60	35.54	85.19
Apr	60.42	30.66	85.68
May	60.36	30.35	86.11

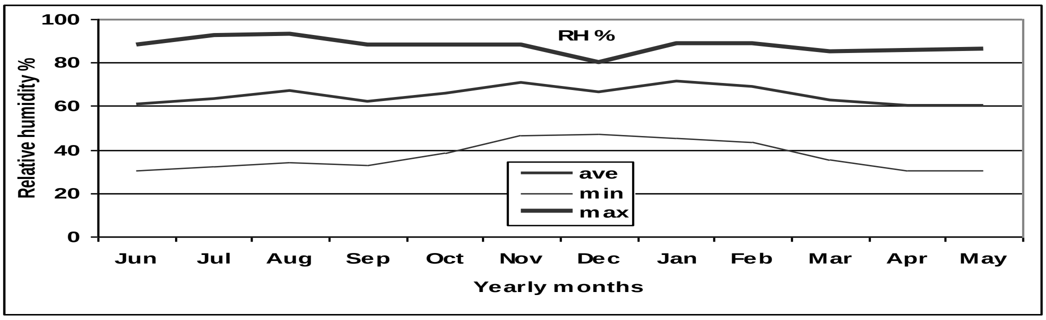


Fig (10): RH, (%) values of the twelve months.

The general trends (RH,%), throughout all the months, were expressed by using the statically mathematically formulas of polynomial, logarithmic, power, exponential and linear as shown in Table (8). These trends showed that, the expression by using the polynomial formula was the best one (r = 0771) to represent (RH,%) than those preceded by the other formulas.

Table (8) : Different statstical regression equations and their coefficients of (RH, %).

Relative humidity (%)			
Statistical equations	**Equations**	**r**	**R^2**
Polynomial	$Y= - 0.2805 X^2 – 3.5937x + 56.849$	0.771	0.594
Logarithm	$Y= 0.8695 \ln(x) + 63.564$	0.164	0.027
Exponential	$Y= 65.305 e^{-0.001x}$	0.055	0.003
Power	$Y= 63.524 x^{0.0129}$	0.158	0.025
Linear	$Y= - 0.0534x + 65.359$	0.045	0.002

The relations between air temperature (T, ^oC) and relative humidity (RH, %):

Graphs collected in Fig (11), depicted the relations between air temperature (T, ^oC) and relative humidity (RH, %) along the 24 daily hours for the twelve months of the year from June to May.

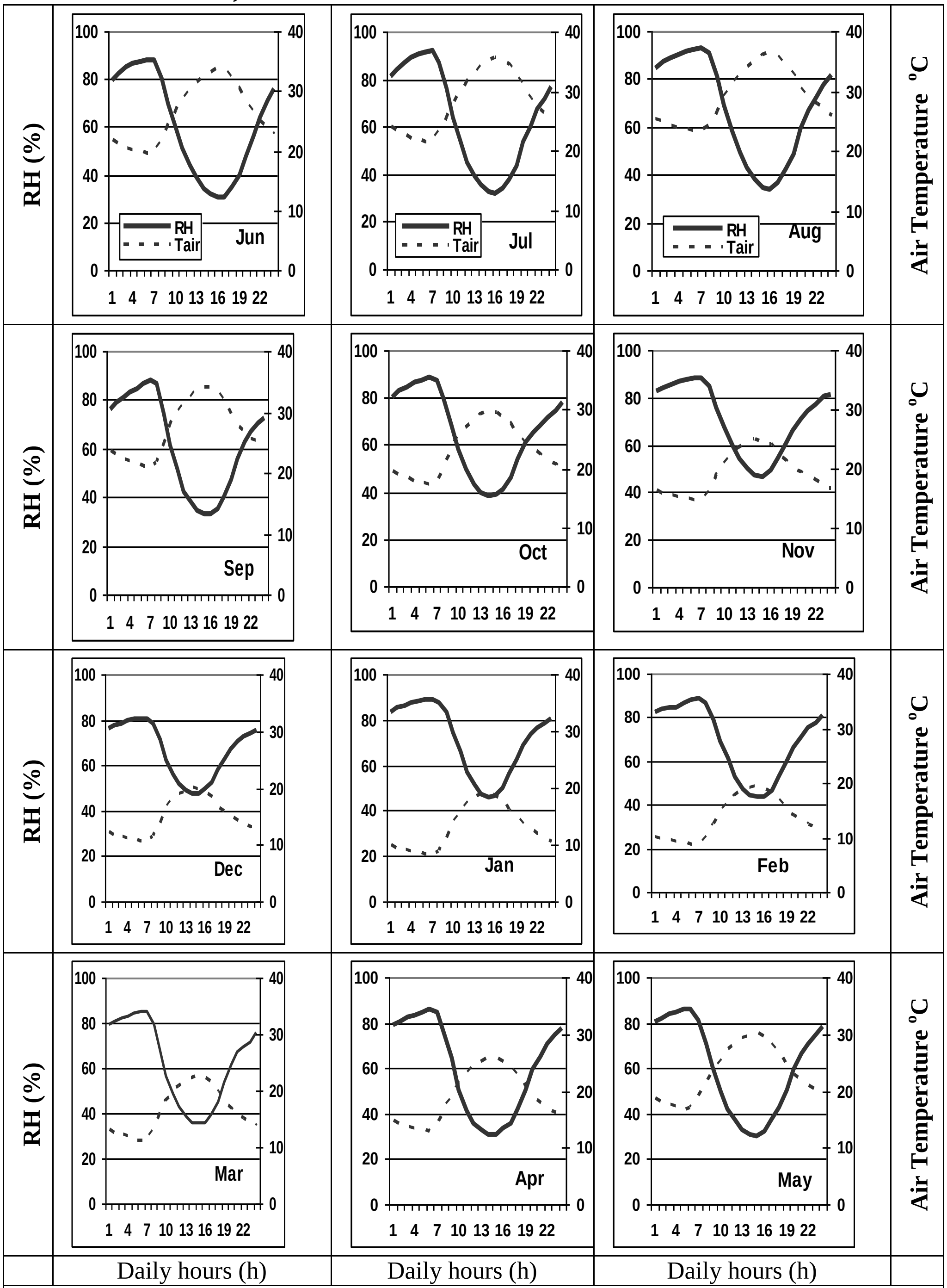
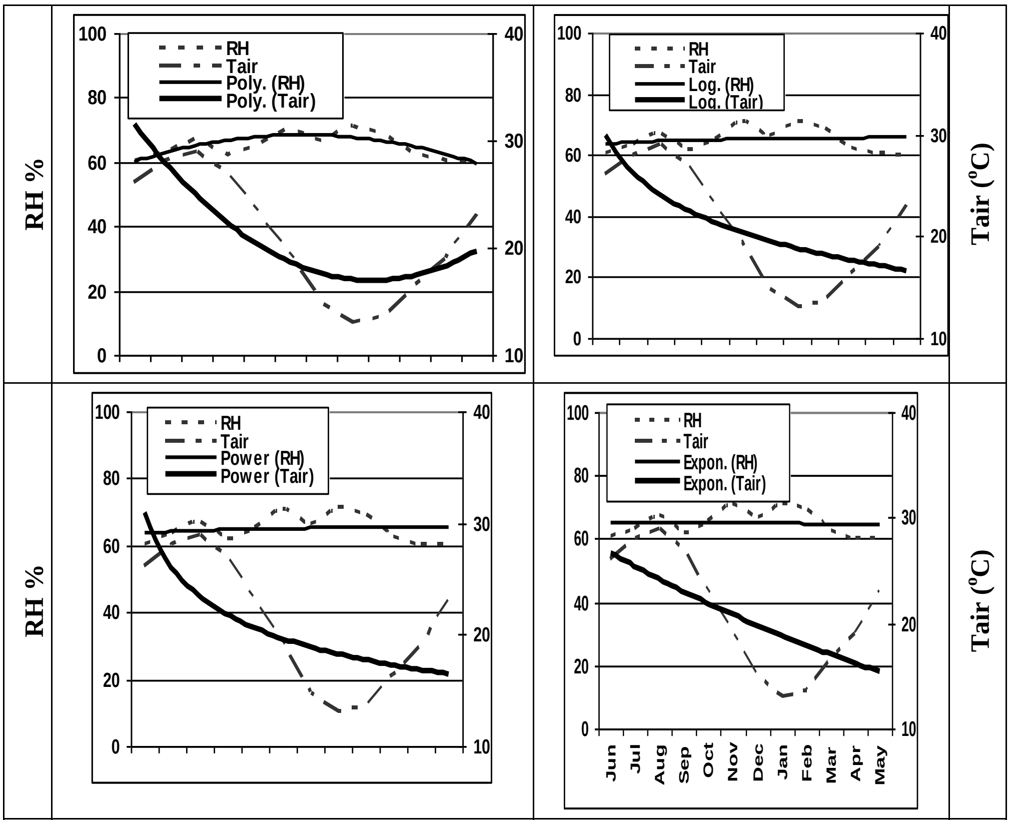


Fig (11): The relations between air temperature (T,°C) and relative humidity (RH,%)



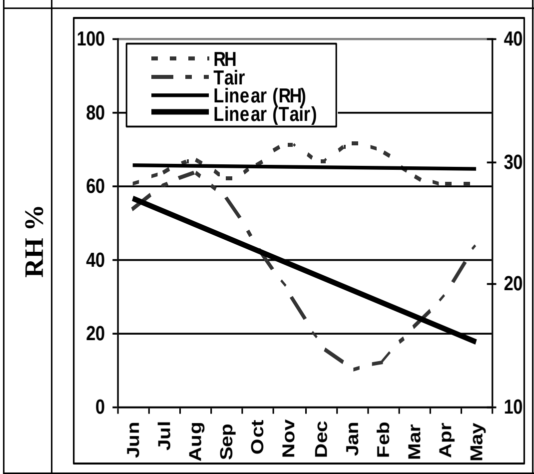


Fig (12): Graphics of different regression equations of the T-air (T, °C) and (RH,%) as polynomial, Logarithmic, Power, exponential, Liner regressions and average linear trend.

Fig (12): Air temperature and relative humidity with the different equations

Generally, Fig (11) showed increasing in air temperatures **(T, °C)** were always accompanied by decreasing in relative humidity **(RH, %)**. The highest increasing of **(T, °C)** accompanied by the lowest decreasing of **(RH, %)** were noticed at 4 p.m. along all the months.

The distance between the rise in **(T, ^{o}C)** and the depression in **(RH, %)** was as far as possible during the month of June, whereas it was as close as possible (almost non- distance) during the month of January.

Data of Table (2) and Table (7) supported this trend, whereas the highest values of the average, minimum and maximum of air temperature **(T, ^{o}C)** and relative humidity **(RH, %)** were noticed in August and their lowest values were noticed in January.

Fig (12) expressed the general trends of both of **(T, ^{o}C)** and **(RH, %)**, throughout all the months, by using the statically mathematically formulas of polynomial, logarithmic, power, exponential and linear. These trends showed that, the expression by using the polynomial formula was the best one to represent the two climate parameters than those preceded by the other formulas.

(5) Dew Point Temperature (TDP, ^{o}C):

The calculated as recorded values of dew point temperature **(TDP, ^{o}C)** were as **Mark (2005) ,** who derivate accuracy and a very simple approximation equation that allows conversion between the dew point, temperature, and relative humidity. This approach is accurate to within about ±1 °C as long as the relative humidity is above 50%:

$$TDP(^{o}C) = Tair(^{o}C) - \left(\frac{100 - RH(\%)}{5}\right)$$

This can be expressed as a simple rule of thumb: "For every 1°C difference in the dew point and dry bulb temperatures **(T, ^{o}C)** , the relative humidity **(RH , %)** decreases by 5% , starting with RH = 100% when the dew point **(TDP, ^{o}C)** equals the dry bulb temperature."

Fig (13) showed the general trends of **(TDP, ^{o}C)** through the 24 daily hours along the 12 months. Figure showed a similarity, in the changes of **(TDP, ^{o}C)** occurring throughout the 24 daily hours, for any studied month. Whereas, the values of **(TDP, ^{o}C)** approximately still constant up to 7 a.m., then start to increase until it reaches the highest increase at 11 a.m., and then begin to decrease until the maximum deficit at 4 p.m., and then increase again until the maximum increase at 11 p.m.

Also Fig (13) showed that, the highest value of **(TDP, ^{o}C)** - which more than 20^{o}C- was recorded in August month. While the average values of **(TDP,^{o}C)** - which ranged from more than 10^{o}C to less than 20^{o}C- were recorded during the months of May, June , July , September, October and November . Whilst, the lowest values of **(TDP, ^{o}C)** - which were less than 10^{o}C- were recorded in the months of December, January, February, March and April.

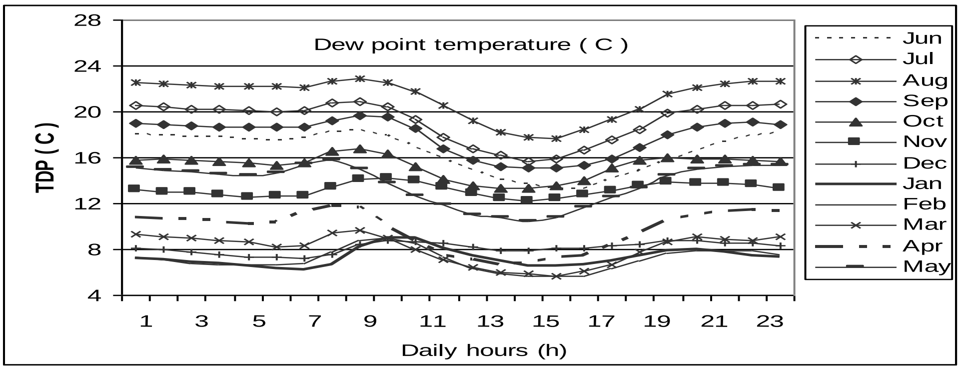


Fig (13): Dew point (TDP,°C) values of the 24 daily hours average of 12 months.

These trends was supported by the data in Table (9) and Fig(14) which depicted that, the highest average , minimum and maximum of **(TDP, °C)** values were noticed in August , while their lowest values were recorded in January and February months.

Table (9) : Average, minimum and maximum of dew point (TDP, °C) values of the 12 months.

Months	TDP (°C)		
	Average	Minimum	Maximum
Jun	16.45	13.22	18.36
Jul	19.16	15.69	20.83
Aug	21.20	17.66	22.91
Sep	17.83	15.06	19.66
Oct	15.27	13.36	16.79
Nov	13.20	12.27	14.20
Dec	8.13	7.18	8.78
Jan	7.31	6.20	9.05
Feb	7.11	5.63	8.96
Mar	8.08	5.62	9.68
Apr	9.70	6.66	11.76
May	13.71	10.47	15.78

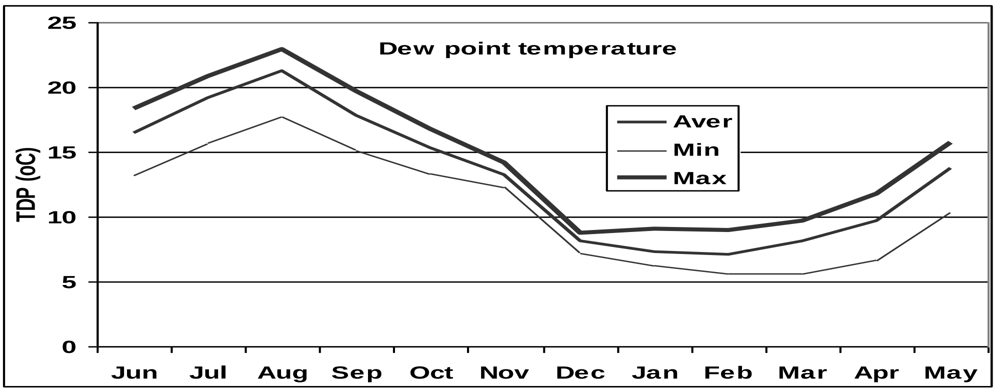


Fig (14): The temperature of dew point (TDP, °C) values along the 12 months

Table (10) : Different statistical regression equations and their coefficients of (TDP ,^{0}C).

TDP (^{0}C)			
Statistical equations	**Equations**	**R**	**R^2**
Polynomial	$Y= 0.1459 X^2 - 2.91x + 24.107$	0.831	0.692
Logarithm	$Y= - 4.7199 \ln(x) + 20.958$	0.717	0.515
Exponential	$Y= 20.201 e^{-0.0775x}$	0.700	0.490
Power	$Y= 22.489 x^{-0.367}$	0.695	0.483
Linear	$Y= - 1.0129x + 19.681$	0.735	0.540

The general trends (TDP, ^{o}C), throughout all the months, were expressed by using the statically mathematically formulas of polynomial, logarithmic, power, exponential and linear as shown in Table (10). These trends showed that, the expression by using the polynomial formula was the best one (r = 0.831) to represent (TDP, ^{o}C), followed by linear equation (r = 0.735) than the other formulas. These statically mathematically formulas will be display as graphically in Fig (16).

Relations between T-air, (^{o}C) and TDP, (^{o}C):

The relations between dew point **(TDP, ^{o}C)** and air- temperature **(T-air, ^{o}C)** through the 24 daily hours along the 12 months were shown in the collected curves in Fig (15). Generally, the values of **(T- air, ^{o}C)** were more than the corresponding values of **(TDP, ^{o}C)**.

On the other hand, in any studied month, Fig (15) showed slight decreasing in **(TDP, ^{o}C)** up to 7 a.m., and then the decline started to rising until it reached to the maximum decline at 2 p.m., then returned to increase again until the maximum increases at 8 p.m.

These daily changes in temperature of dew point **(TDP, ^{o}C)** were accompanied by similar changes in **(T-air, ^{o}C)**, but with highly increasing in **(T-air, ^{o}C)** starting from 7 a.m. up to the more obvious increasing until it to the maximum increasing at ~ 3 p.m. , then returned to decrease again until the maximum decrease at 10 p.m. The distance between the rise in **(T-air, ^{o}C)** and the depression in **(TDP, ^{o}C)** was as far as at ~ 3 p.m. and were more obvious during the months of June, July and August.

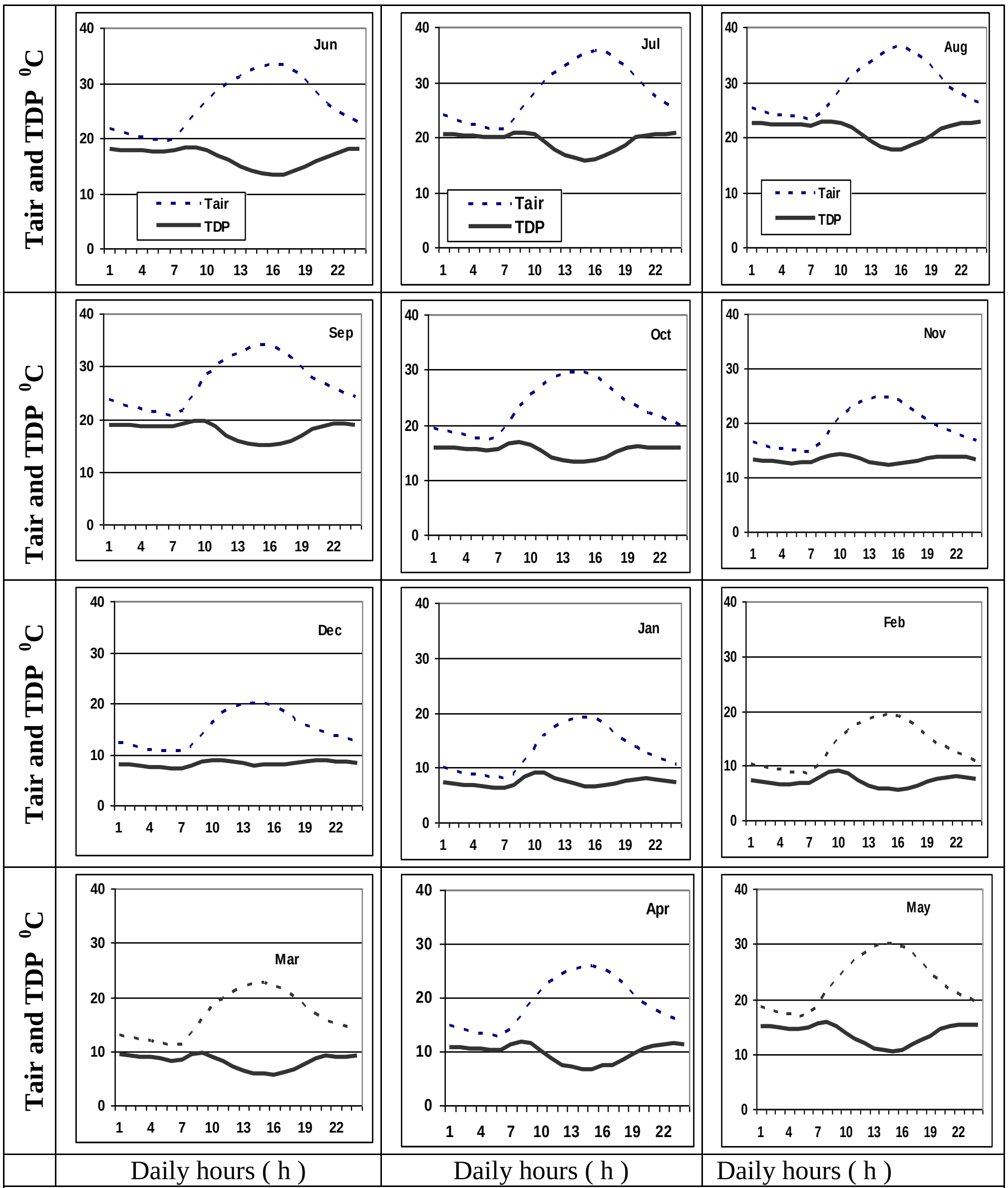


Fig (15): The relations between air temperature (T) (°C) and TDP (°C)

Fig (16) expressed the general trends for both of (TDP, °C) and (Tair °C), throughout all the months, by using the statically mathematically formulas of polynomial, logarithmic, exponential, power and linear.

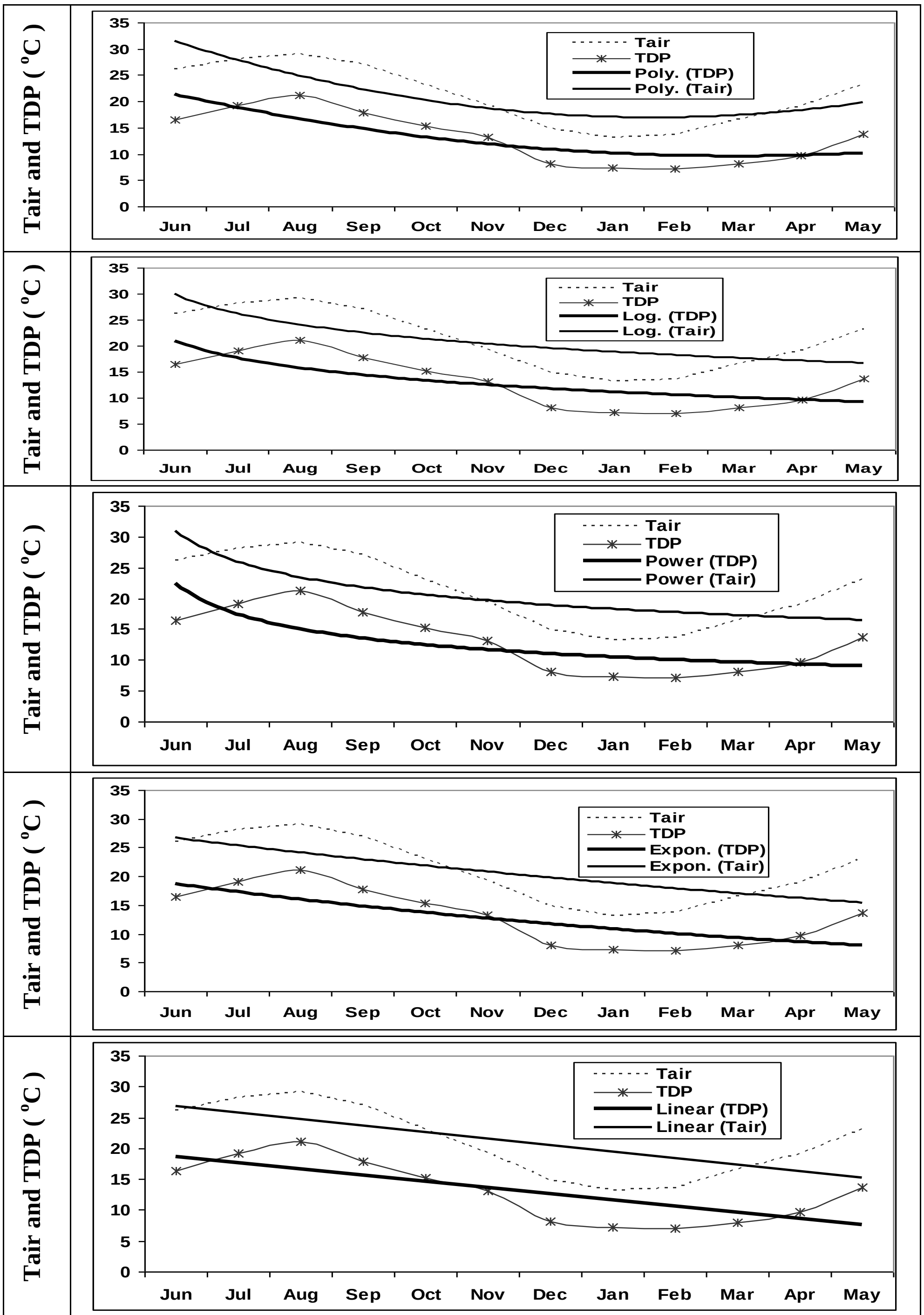


Fig (16): Different statistical parameters for climatical changes (Tair and TDP)

Relations between (T- air, °C), (SVP, kPa) (VP, kPa) and (TDP, °C):

The previous trend which showed that the highest values of **(T-air, °C)** were noticed in August, while their lowest values were recorded in January and February months where they were noticed in the same trend with respect to all of **(TDP, °C), (SVP, kPa) (VP, kPa)** as shown in Fig (17). Also, there were noticed that TDP (°C) very adjacent to SVP (kPa) and far from Tair (°C) and VP (kPa).

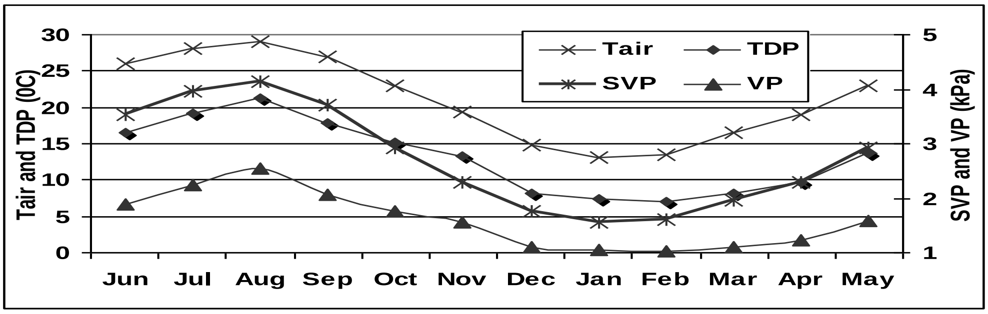


Fig (17): The general trends of (Tair, °C), (TDP,°C), (SVP, kPa) and (VP, kPa) for the 12 months.

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بعض الظواهر الجوية المختلفة للهواء بالقرب من سطح التربة فى الإسماعيلية

صادق الريس* وطارق عبد الرحمن أبوالضيفان* و صلاح السيسى* وحسن على احمد طه**

*معهد بحوث الأراضى والمياه والبيئة (مصر- الجيزة) - مركز البحوث الزراعية

** معهد بحوث وقاية النباتات - الدقى – مركز البحوث الزراعية

أجريت هذه الدراسة في محطة البحوث الزراعية بالإسماعيلية، مركز البحوث الزراعية ، لدراسة العلاقات بين بعض الظواهر الجوية في الهواء الرطب بالقرب من سطح التربة. ولتحقيق هذا الهدف، فإنه تم قياس درجة حرارة الهواء **(T, ^{o}C)** وضغط بخار الماء (VP, kPa) المسجلة من وحدة الأرصاد الجوية وتم حساب الرطوبة النسبية **(RH %)** وضغط البخار المشبع **(SVP, kPa)** وتم تسجيل ويمكن ايضا حساب درجة حرارة الندى **(TDP, ^{o}C)** من قبل محطة قياسات الأحوال الجوية التابعة للمحطة البحثية بالإسماعلية.

وبالنسبة لدرجة حرارة الهواء **(T, ^{o}C)** أظهرت بداية الإرتفاع الساعة السابعة صباحا، وأخذت فى الإزدياد حتى بلغت ذروة الإرتفاع عند الساعة الثالثة بعد الظهر ، وقد إختلف مقدار الإرتفاع وتوقيته من شهر لآخر وقد إتضح ذلك من خلال قراءات المتوسطات لساعات اليوم (h) خلال الاثني عشر شهرا محل الدراسة. وفي الوقت نفسه وعلى مدارالـ ٢٤ ساعة يوميا،حيث تناقصت الرطوبة النسبية **(RH %)** فى سلوك مضاد لدرجة حرارة الهواء **(T, ^{o}C)**.

وكان ضغط البخار المشبع **(SVP, kPa)** مرتفعا خلال شهر أغسطس وكان منخفضا خلال أشهر ديسمبر ويناير وفبراير ، وكان هذا الاتجاه مرتبطا بدرجة حرارة الهواء. كما أظهر ضغط بخار الماء **(VP,kPa)** إنخفاض وقد كان أكثر إنخفاضا عند الساعة الثالثة بعد الظهر فى جميع الأشهر، كما أظهرت إنخفاضا شديدا في شهري يناير وفبراير، وكانت مرتفعة نسبيا في شهري يوليو وأغسطس. وأظهرت العلاقة بين درجة حرارة الهواء **(T, ^{o}C)** ودرجة حرارة نقطة الندى **(TDP, ^{o}C)**، على مدى أشهر القياس أن قيم **(T, ^{o}C)** أكثر من القيم المقابلة لـ **(TDP, ^{o}C)**. حيث كان الفرق فى الارتفاع في درجة الحرارة **(T, ^{o}C)** والانخفاض فى درجة حرارة نقطة الندى **(TDP, ^{o}C)** ابعد مايمكن عند الساعة الثالثة من بعد الظهر، وكان هذا الإتجاه أكثر وضوحا خلال أشهر يونيو ويوليو وأغسطس.

كما أمكن تمثيل العلاقات بين كل من ضغط بخار الماء المشبع **(SVP, kPa)** وضغط بخار الماء **(VP, kPa)** ودرجة حرارة الهواء **(T, ^{o}C)** والرطوبه النسبية **(RH %)** ودرجة حرارة الندى **(TDP, ^{o}C)** من خلال الصيغ الرياضية في صورة خمس معادلات هى (١) متعددة الحدود، (٢) لوغارتميه، (٣) أسيه، (٤) قوى، و(٥) خطيه.

وتبين أن أفضل تمثيل للعلاقات الأحصائية التى تم تطبيقها للصفات المناخية المدروسه هى علاقة البلونوميل (معادله متعددة الحدود) مقارنة بالمعادلات الأخرى. حيث أن افضل معامل أنحدار **( ) r**فى هذه المعادلات لكل من **SVP، VP، T، RH، TDP** هى ٠.٨٣ ، ٠.٨٠، ٠.٨١، ٠.٧٧، ٠.٨٣ على التوالى ، وأن أفضل معامل كان للضغط البخارى المشبع ودرجة حرارة الندى.