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Impact of different natural hosts and meridic diet on fatty acid profiling of *Spodoptera litura* (Fabricius) vis-à-vis reproductive physiology

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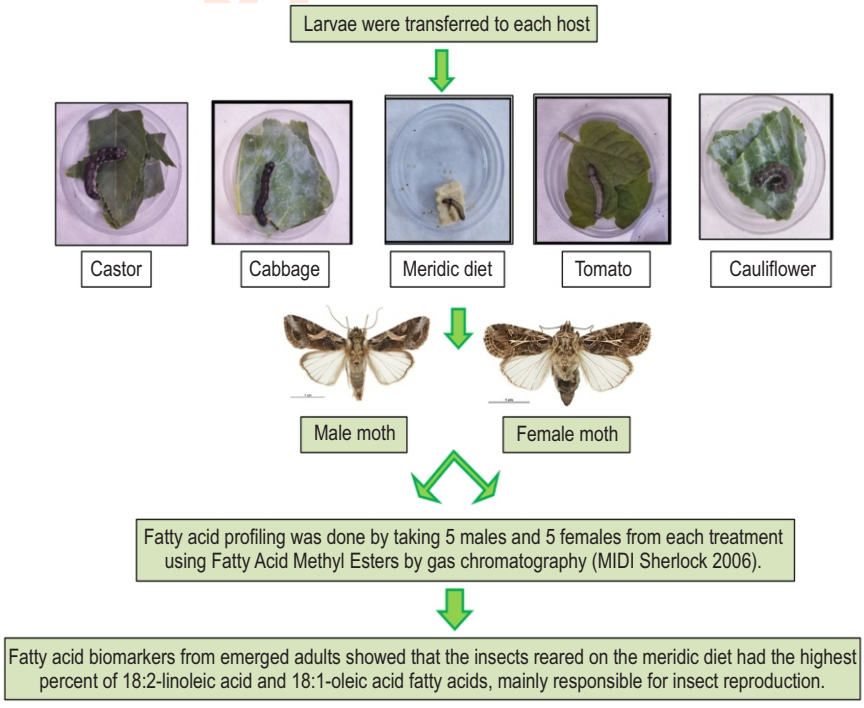
Abstract

Aim: This study was undertaken to document the influence of natural hosts and meridic diet on fatty acid profiling vis-a-vis reproductive physiology of *Spodoptera litura* (Fabricius).

Methodology: *S. litura* were larvae fed on various hosts (castor, cauliflower, cabbage and tomato) and meridic diet. After emergence, the adults were frozen in liquid nitrogen. Fatty acid analysis was conducted by Fatty Acid Methyl Esters through gas chromatography (MIDI Sherlock, 2006).

Results: One-way ANOVA and Principal component analysis (PCA) of fatty acid biomarkers from emerged adults showed that the insects reared on meridic diet had the highest percent of linoleic acid (18:2) and oleic acid (18:1) fatty acids, which are mainly responsible for insect reproduction. Interestingly, reproduction related fatty acids were distributed proportionally in case of adults emerged from meridic diet fed larvae.

Interpretation: Fatty acid profile can be used as a surrogate marker to assess the reproductive fitness of insects. The study also concluded that the meridic diet would be an alternate choice in the absence of natural hosts for mass rearing of *S. litura* throughout the year.



Key words: Fatty acid, Meridic diet, Oleicacid, Principal component analysis, *Spodoptera litura*

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Introduction

Spodoptera litura (Lepidoptera: Noctuidae), the tobacco cutworm, is one of the most destructive and pervasive polyphagous insect pest. It is extensively found in the Pacific Islands, Australasia, and tropical and temperate Asia (Ranga Rao *et al.,* 1993). According to Maes (2022), it feeds on at least 389 commercially significant plant species from 109 families, including vegetables, cotton, flax, groundnuts, lucerne, maize, rice, soybean, tea, and tobacco. *S. litura* is known to cause 25.8 to 100% economic loss in agricultural crops (Sahu *et al.,* 2020). Acquiring a basic understanding of pest biology and its biotic potential is necessary before designing any insect control measures.Insect rearing in laboratories is vital for scientific research, disease control, pest management, conservation initiatives, technology development, and teaching (Sørensen *et al.,* 2012). According to Chakraborty and Newton (2011), it offers controlled conditions for investigating insects, adjusting parameters, and developing effective solutions to a range of problems pertaining to insects and their interactions with the environment and human society.

The quality of the host plant plays a major impact on the fertility of herbivorous insects while rearing (Awmack and Leather, 2002). Insect herbivores respond differently within and between feeding guilds to changes in the quality of their host plants (Salgado *et al.,* 2019). Egg size and quality, nutrition distribution to eggs, oviposition site selection, and egg or embryo resorption on inadequate hosts are influenced by host plant quality (Riddick *et al.,* 2018; Huck *et al.,* 2021). Natural food supplies are insufficient for the continuous and prolonged rearing of insects, even if they are rich in nutrients (Kim *et al.,* 2019). As an alternative, artificial diets for insects are a helpful tool used by entomologists to understand the nutritional requirements of insects, investigate their biology, and design pest management measures (Cohen, 2001). According to Cunningham *et al.* (2001), the host has a major influence on the life cycle characteristics, abundance, and survival of insects. Fatty acids play a vital role in insect reproduction and significant synthesis functions. The number and composition of diverse lipids known as free fatty acids (FFAs) found in the cuticle vary substantially based on the environment and diet (Kaczmarek *et al.,* 2021). The roles they play in the development of reproductive organs, hormone synthesis, pheromone production, sperm production, and egg development eventually affect the reproductive success of insects (Zhang *et al.,* 2021).

The role of fatty acids in reproduction has already been emphasized by many researches, Queensland fly larvae, pupae, and adults require polyunsaturated fatty acids (PUFAs) in their diet for their optimal growth. Linolenic acid is crucial for flight ability, while linoleic acid (LA) is necessary for the production of adult eggs (Moadeli *et al.,* 2020). Additionally, fatty acids serve as precursors to pheromones synthesis for sexual attraction and epideictic activities, such as display behaviors (Kaczmarek and Boguś, 2021). It has been reported that the storage of fatty acids and glucose in insects is crucial for various functions and alongside fatty acids act as precursors for the synthesis of eicosanoids and pheromones and they are required for the production of phospholipids and waxes (Arrese and Soulages, 2010). The findings of this study on fatty acids *vis-a-vis* reproductive physiology will provide justifications for choosing best hosts for insect rearing to assess different xenobiotics and to design effective integrated pest management strategies. In light of the aforementioned, a sincere effort was made to examine the effects of various hosts and meridic diet on the fatty acid profile of *Spodoptera litura.*

Materials and Methods

The experiment on the effects of natural host and meridic diet on reproductive attributes and fatty acid profile of *Spodoptera litura* was carried out at the Division of Entomology, ICAR-IARI, New Delhi, under controlled conditions (27±1°C, 65±5 % RH and photoperiod of 14:10 hours of L: D). The larvae of *S. litura* were collected from capsicum crop cultivated in the fields and reared on different hosts and chickpea-based meridic diet (Sagar *et al.,* 2022). On emergence, pair of adults were transferred to mating jars (20 × 15 cm) containing droplets of 10% honey solution. Paper strips were placed in the mating jars for egg laying, and the jars were covered by black muslin cloth. Egg masses were collected daily and transferred to Petri plate containing the respective host for hatching. A total of four natural host plants *viz., Ricinus communis* (Castor), *Brassica oleracea var. capitata* (Cabbage), *Brassica oleracea var. botrytis* (Cauliflower), and *Solanum lycopersicum* (Tomato) and chickpea based meridic diet were used. A cohort of 150 eggs laid in a day were used for the study, the hatched 100 neonates were individually reared on selected host plants and meridic diet in small Petri plates (diameter=4 cm and height=1cm). The larvae were fed on selected hosts for two generations (host conditioning). The leaves of different host plants and a slice of meridic diet were provided to larvae on alternate days until pupation.

Later, ten male and female adults emerged from different hosts and the diet were taken for fatty acid profiling, the adults were first powdered with liquid nitrogen, and later 2 g from each sample was used for fatty acid profiling. The saponification, methylation process and extraction of cellular fatty acids were performed according to the methodology described by Čechová *et al.* (2004) with slight modifications. For optimal analysis of Fatty Acid Methyl Esters by gas chromatography, the Sherlock MIS Software (MIDI Sherlock 2006) was used with Agilent technologies 6890 Gas Chromatograph. Gas Chromatograph was performed by following the programme, temperature program ranging from 170 to 270°C at 5°C per minute. The significance of different fatty acid biomarkers of *S. litura* reared on different diets was analyzed through One-way ANOVA in SPPS 20.0 and data was represented as mean±S.E. Principal Component Analysis (PCA) was done for total fatty acids extracted from adult male and female moths emerged from larvae fed on different diets. Statistical analysis was conducted using R software (version 4.1.0).

Results and Discussion

Spodoptera litura, like several other lepidopteran insects, has a vast and expanding geographical range and depends on multitudinous hosts for its larval development. The nutritional value and palatability of the host plants that insects feed on determine their development, ability to reproduce and general fitness. Thorough analysis of life tables derived from cohorts raised on certain host plants under laboratory circumstances, the compatibility of host plant can be determined (Ning *et al.,* 2017). Among all nutrient sources, fatty acids are a critical factor for their development and reproduction and insects like crickets, locusts, flies, stinkbugs, and termites predominantly contain fatty acids such as oleic acid (SFA), palmitic acid (MUFA) and linoleic acid (PUFA)(Kinyuru *et al.,* 2013; Akullo *et al.,* 2018; Mariod, 2020). The survival of pests amidst environmental changes heavily relies on the biochemical processes governing fatty acid metabolism. Studies reveal that the presence of saturated and unsaturated fatty acids can have a substantial effect on a range of pest biology characteristics, including environmental adaption, feeding preferences and resistance. For example, Kordan *et al.* (2019) observed that the composition of fatty acids influences vital biological activities in *Sitophilus granarius,* with fatty acids such as MUFA (C 18:1) and PUFA (C 18:2) having a significant impact on survival rates. Similar to this, it was found that *S. oryzae* preferred wheat cultivars high in polyunsaturated fatty acids (C18:2), which helped the pest develop more effectively (Kosewska *et al.,* 2024).

In the present study, the fatty acid profiles of adult males and females emerged from larvae fed on different host plants like cabbage, cauliflower, tomato, castor and meridic diet were determined, and the results showed that in total 67 fatty acids were recorded in females and 41 in males, respectively. Palmitic (16:0), palmitoleic (16:1), stearic acid (18:0), oleic (18:1) and linoleic (18:2 w6, 9c) acids were predominant fatty acids in both male females of *S. litura.* The cis-vaccenic acid (18:1 w7c) was totally absent in males and females emerged from meridic diet-fed larvae. From previous studies it was clarified that lepidoptera contain high levels of non-essential fatty acids such as oleic, palmitic and stearic acid. Additionally, essential fatty acids like alpha-linolenic acid and linoleic acid cannot be synthesized by Lepidopterans and are crucial for adult reproduction (Canavoso *et al.,* 2001). In male adults, the highest saturated fatty acids (SFA) content was found in the larvae that fed on cauliflower (50.09%) and cabbage (49.22%), while in other hosts like meridic diet, tomato, and castor, it was 37.9, 39.12 and 43.69 percent respectively. The highest monounsaturated fatty acid (MUFA) content was found in the larvae fed on castor (52.29%) and tomato (48.98 %), while in other hosts like meridic diet, cauliflower, and cabbage, it was 34.91, 44.5 and 46.28 percent respectively. The highest polyunsaturated fatty acids (PUFA) content (27.13 %) was found in males that emerged from meridic diet (Table 1). In females, the highest content of SFAs was found in the larvae that fed on cauliflower (47.88%), followed by tomato (43.83%), castor (43.73%), cabbage (40.85%) and meridic diet (36.56%). MUFAs content was found in larvae fed on castor (51.42%), cabbage (50.3%) and tomato (49.83%) whereas MUFAs contents were reported lowest in meridic diet and cauliflower, respectively. Aside from that, larvae fed on meridic diet had the highest percentage of PUFAs (30.54%), which is responsible for reproduction (Table 2). In reference to the above findings, it is evident that fatty acids play crucial roles in embryonic development, metamorphosis and reproductive processes (Peng *et al.,* 2023).

Eicosanoids, derived from polyunsaturated fatty acids are identified as key in inducing oviposition in crickets and likely play a significant role in insect reproduction (Morales-Ramos *et*

Table.1: Effect of different hosts on fatty acid profiling of male moth

Fatty Acids	IUPAC Name	Meridic diet (%)	Cauliflower (%)	Cabbage (%)	Tomato (%)	Castor (%)	*p*
14:0	12-Methyltridecanoic Acid	0.75±0.005^{d}	1.26±0.009^{b}	1.2±0.012^{c}	0.76±0.005^{d}	1.42±0.017^{a}	<0.0001
16:0	14-Methylpentadecanoic Acid (Palmitic acid)	34.47±0.52^{c}	40.81±0.12^{b}	42.6±0.27^{a}	31.83±0.43^{d}	35.01±0.54^{c}	<0.0001
18:0	Octadecanoic Acid (Stearic Acid)	1.5±0.01^{c}	1.46±0.01^{c}	1.77±0.01^{b}	2.27±0.03^{a}	1.29±0.01^{d}	<0.0001
∑SFAs		**37.9±0.36^{c}**	**50.09±0.80^{a}**	**49.22±0.77^{a}**	**39.12±0.06^{c}**	**43.69±0.23^{b}**	**<0.0001**
16:1 w7c	(9Z)-9-Hexadecenoic Acid	2.57±0.03^{d}	4.49±0.04^{b}	7.65±0.05^{a}	2.37±0.004^{e}	3.17±0.03^{c}	<0.0001
18:1 w7c	(11Z)-11-Octadecenoic Acid (cis-Vaccenic Acid)	0±0.00^{e}	16.41±0.17^{c}	15.48±0.22^{d}	24.44±0.28^{b}	31.19±0.40^{a}	<0.0001
18:1 w9c	(9Z)-9-Octadecenoic Acid (Oleic Acid)	31.7±0.42^{a}	23.31±0.19^{b}	22.38±0.26^{c}	21.44±0.21^{d}	16.38±0.23^{e}	<0.0001
∑MUFAs		**34.91±0.17^{e}**	**44.5±0.04^{d}**	**46.28±0.72^{c}**	**48.98±0.63^{b}**	**52.29±0.56^{a}**	**<0.0001**
18:2 w6,9c	(9Z,12Z)-9,12-Octadecadienoic Acid (Linoleic Acid (LA))	27.13±0.05^{a}	2.84±0.005^{e}	4.36±0.04^{c}	9.37±0.06^{b}	3.3 ±0.03^{d}	<0.0001
∑PUFAs		**27.13±0.27^{a}**	**2.93±0.02^{e}**	**4.44±0.04^{c}**	**9.44±0.12^{b}**	**3.3±0.01^{d}**	**<0.0001**

Means ± SE within a row represented by different lowercase letters is significantly different for a particular trait (P<0.05; Tukey's post-hoc test). SFA – Total saturated fatty acids; MUFA- Total monounsaturated fatty acids; PUFA- Total polyunsaturated fatty acids (The above data is in percentage).

Table. 2: Effect of different hosts on fatty acids profiling of female moth

Fatty Acids	IUPAC Name	Meridic diet (%)	Cauliflower (%)	Cabbage (%)	Tomato (%)	Castor (%)	*p*
14:0	12-Methyltridecanoic Acid	0.6±0.009^{c}	1.11±0.016^{a}	1.12±0.013^{a}	1.05±0.008^{b}	1.11±0.002^{a}	<0.0001
16:0	14-Methylpentadecanoic Acid (Palmitic acid)	32.51±0.022^{cd}	34.8±0.497^{b}	31.77±0.497^{d}	39.35±0.080^{a}	32.86±0.391^{c}	<0.0001
18:0	Octadecanoic Acid (Stearic Acid)	2.16±0.002^{b}	2.06±0.016^{d}	2.12±0.015^{c}	1.85±0.009^{e}	2.2±0.002^{a}	<0.0001
∑SFAs		**36.56±0.485^{d}**	**47.88±0.472^{a}**	**40.85±0.277^{c}**	**43.83±0.566^{b}**	**43.73±0.699^{b}**	**<0.0001**
16:1 w7c	(9Z)-9-Hexadecenoic Acid	1.9±0.009^{e}	3.17±0.003^{c}	3.7±0.020b	5.01±0.049^{a}	2.21±0.021^{d}	<0.0001
18:1 w9c	(11Z)-11-Octadecenoic Acid (cis-Vaccenic Acid)	29.35±0.299^{a}	23.26±0.134^{b}	20.44±0.062^{c}	23.2±0.063^{b}	18.32±0.006^{d}	<0.0001
18:1 w7c	(9Z)-9-Octadecenoic Acid (Oleic Acid)	0±0e	16.81±0.028^{d}	24.16±0.065^{b}	20.91±0.277^{c}	28.03±0.381^{a}	<0.0001
∑MUFAs		**32.69±0.011^{d}**	**44.84±0.350^{c}**	**50.3±0.616a^{b}**	**49.83±0.457^{b}**	**51.42±0.367^{a}**	**<0.0001**
18:2 w6,9c	(9Z,12Z)-9,12-Octadecadienoic Acid (Linoleic Acid (LA))	30.49±0.321^{a}	6.33±0.017^{c}	8.67±0.032^{b}	6.03±0.053^{d}	3.9±0.019^{e}	<0.0001
∑PUFAs		**30.54±0.488^{a}**	**6.41±0.080^{c}**	**8.76±0.056^{b}**	**6.06±0.098c**	**4±0.016^{d}**	**<0.0001**

Means ± SE within a row represented by different lowercase letters are significantly different for a particular trait (P<0.05; Tukey's posthoc test). SFA – Total saturated fatty acids; MUFA- Total monounsaturated fatty acids; PUFA- Total polyunsaturated fatty acids(The above data is in (%)percentage)

al., 2023). Many insect pheromones, which serve various functions including attraction, aggression, aphrodisiac effects, anti-aphrodisiac effects, aggregation, kin identification, and alarm signaling are derivatives of fatty acids (Zhang *et al.,* 2021). Linoleic acid, an essential nutrient found across diverse organisms, plays critical roles in cell physiology, immunity and reproduction (Malcicka *et al.,* 2018). Prabhu *et al.* (1987) noted that many insects require unsaturated fatty acid, linoleic acid for healthy development and reproduction. In host plants, secondary metabolites, proteins and carbohydrates regulate insect growth and development (Le Gall *et al.,* 2014).

Low-cost and effective artificial diets are selected to meet the demand for the desired number of insects raised in laboratories. Proteins, carbohydrates, lipids, vitamins, minerals and preservatives are the main elements of any artificial diet that aid in the growth and development of insects (Bisht *et al.,* 2018). Overall, PUFAs proportion was less as compared to MUFAs and SFAs in the adults emerged from the larvae fed on natural hosts. Still, individually it was highest in the meridic diet, which signifies its importance in fecundity which was higher in the case of adults emerged from meridic diet-fed larvae. Total PUFAs content ranged from 3.3 to 27.13 % in males and 4.0 to 30.5 % in females by dry weight across diet treatments (Table 1,2). Linoleic acid (4–30.5 %) was the most prevalent PUFA. Palmitic acid (32–40%) and stearic acid (1-3%) were the most prevalent fatty acids, with a proportion of SFAs ranging from 36 to 50%. MUFAs contents ranged from 34–53%, where as the oleic acid contributed 20–29%, followed by vaccenic acid (16-30%) (Table 1). For maintaining good health, it is recommended that the proportion of SFAs, MUFAs, and PUFAs should be maintained within the ratio of 1:1.5:1 for humans (Grover et al., 2021). However, the optimal proportion of these fatty acids for improved reproductive fitness in insects is still unknown. In this context, the recommended ratio for humans will explain why the proportions of SFA, MUFA and PUFA are found approximately 1:1:1 in larvae fed on meridic diet, indicating the balanced availability of fatty acids for insect reproduction. The role of fatty acid is always a key factor in reproduction as previous studies suggest that the PUFAs and PUFA-derived signaling have been linked to early developmental events such as meiosis, fertilization, and early embryonic cleavage in *Drosophila melanogaster* and nematode, *Caenorhabditis elegans* (Vrablik *et al.,* 2013). The perusal of data reveals that as compared to castor and other natural diets, the PUFAs (Linoleic acid) and MUFA (oleic acid) contents were higher in the meridic diet, which is vital for insect reproduction. The results of this study reiterate that fatty acid profile of insects can be used as a reliable marker to gauge the reproductive fitness of insects.

Dietary practices are a significant component essential for survival of insects, which are vital for their growth and development during early stages of life cycle (Friend *et al.,* 1982). The results from previous studies reveal that, the idea of a representative fatty acid composition in insects was rejected, arguing that these patterns are not fixed descriptors. Instead, diet and development plays significant roles in determining their fatty acid profiles (Visser *et al.,* 2013). For example, during development of ontogeny, pine beetle (*Dendroctonus frontalis*), lyctus beetle, fruit flies (*Dacus oleae*) and *Ceratitis capitata,* and wax moth (*Galleria mellonella*) under went changes in fatty acid composition. Similar modifications occurred during the embryonic development of cockroach (*Periplaneta americana*) (Stanley-Samuelson *et al.,* 1988). Furthermore, numerous studies have demonstrated that insects' fatty acid compositions adapt to different levels of dietary polyunsaturated fatty acids (PUFAs), typically indicating that higher dietary polyunsaturated fatty acid led to increased tissue PUFAs and decreased tissue MUFAs. Thus, the fatty acid profile can serve as a stand-in marker

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Table 3: PCA analysis for fatty acid biomarkers of female moth emerged from larvae fed on different hosts

Principal Components	Eigenvalue	Percentage of variance	Cumulative percentage of variance
PC_1	4.52	90.34	90.34
PC_2	0.44	8.89	99.23
PC_3	0.03	0.63	99.86
Pc_4	0.00	0.09	99.95
PC_5	0.00	0.04	100

Table 4: PCA analysis for fatty acid biomarkers of male moth emerged from larvae fed on different hosts

Principal Components	Eigenvalue	Percentage of variance	Cumulative percentage of variance
PC_1	4.45	89.18	89.18
PC_2	0.44	8.86	98.04
PC_3	0.09	1.83	99.87
Pc_4	0.00	0.09	99.97
PC_5	0.00	0.02	100

for evaluating an insect's fitness for reproduction (Yang *et al.,* 2006). Many insects require unsaturated fatty acid, linoleic acid for proper development and reproduction (Rabiee *et al.,* 2015).

PCA bio-plots analysis was performed using five variables (meridic diet, cauliflower, cabbage, tomato, and castor) for both male and female adult moths that emerged from larvae fed on different diets like meridic diet, cauliflower, cabbage, tomato and castor. PCA for both male and female moth *S. litura* moth was performed with five variables (diets) for a 20 variance of fatty acids biomarkers. The results showed that in males, the highest percent variance was found in PC_1 (89.2%) followed by PC2 (8.9%), with the Eigen values of 4.45 and 0.44 (Table 4), with respect to fatty acids biomarkers and diets (Fig.1A, B). In case of female moth, the highest eigenvalues of 4.52 and 0.44 (Table 3) were selected, as they accounted for 90.34% (PC_1) and 8.89% (PC_2) of variance (Fig. 2 A, B). Both *biplot* and *rplot* showed that in all the larvae fed on different diet viz., meridic diet, cauliflower, cabbage, tomato and castor were positively related to PC_1 and PC_2 (Fig. 1 A,B, 2 A, B). It was observed that variation in fatty acid prevail across all the diets containing good amount of fatty acid in both males and females as every line touched the periphery in *rplot* (Fig.1 B, 2 B). The meridic diet contributed the maximum amount of fatty acids necessary for insect development and reproduction compared to other diets, as indicated by the clustering of reproductively important fatty acid biomarkers near the meridic diet compartment in the PCA analysis. On the contrary four diets such as castor, cauliflower, cabbage, and tomato contributed similar fatty acid variation as they close acute angle among them (Fig. 1B, 2 B). Among all diets, the meridic diet has the highest percentage of fatty acid biomarkers, particularly MUFA (biomarker-14) as well as PUFA (biomarker-13) like oleic acid (18:1 w9c) and linoleic acid (18:2 w6,9c). Both male and female moths need these markers for insect reproduction, thereby indicating feeding on meridic diet enhances the reproductive capacity of insect.

The results of Principal Component Analysis align with previous research (Mattioli *et al.*, 2024). Specifically, linoleic and oleic acids play a significant role in the development of aphidophagous syrphids, *Eupeodes bucculatus.* Adults fed an diet enriched with these acids exhibited larger body sizes and longer forewings compared to those fed on other diets. Additionally, this diet resulted in the highest emergence rate and maximum body size, enhancing reproductive strength (Iwai *et al.,* 2009). On other hand, the linoleic and linolenic acid are precursors of prostaglandin, which regulate ovarian development and ovipositional behavior that plays on important role in insect growth and development (Blomquist *et al.,* 1991). Previous studies have focused on reporting data according to which during the reproductive cycle of insects, monounsaturated fatty acids prevail, namely palmitoleic acid and oleic acid, together with polyunsaturated acids—linoleic and linolenic (Sayah *et al.,* 2008). Similarly, oleic acid levels had a significant impact on bees, elevating birth weight by 41.1% 59% ovary weight, 29.3% in the number of oocytes per ovary, and 57.4% in spawning amount (Rabiee *et al.,* 2015). The most significant energy-storing molecules in insects are fatty acids, which also serve as the building blocks for the development of insects' embryos, metamorphosis, flight, and other processes (Chen *et al.,* 2023). Eventually, the availability of linoleic acid and other polyunsaturated fatty acids affects the fecundity of many animals by maintaining the fluidity of spermatozoa, required for the formation of zygotes (Wathes *et al.,* 2007). The above points highlight the significance of fatty acids as crucial biomarkers in

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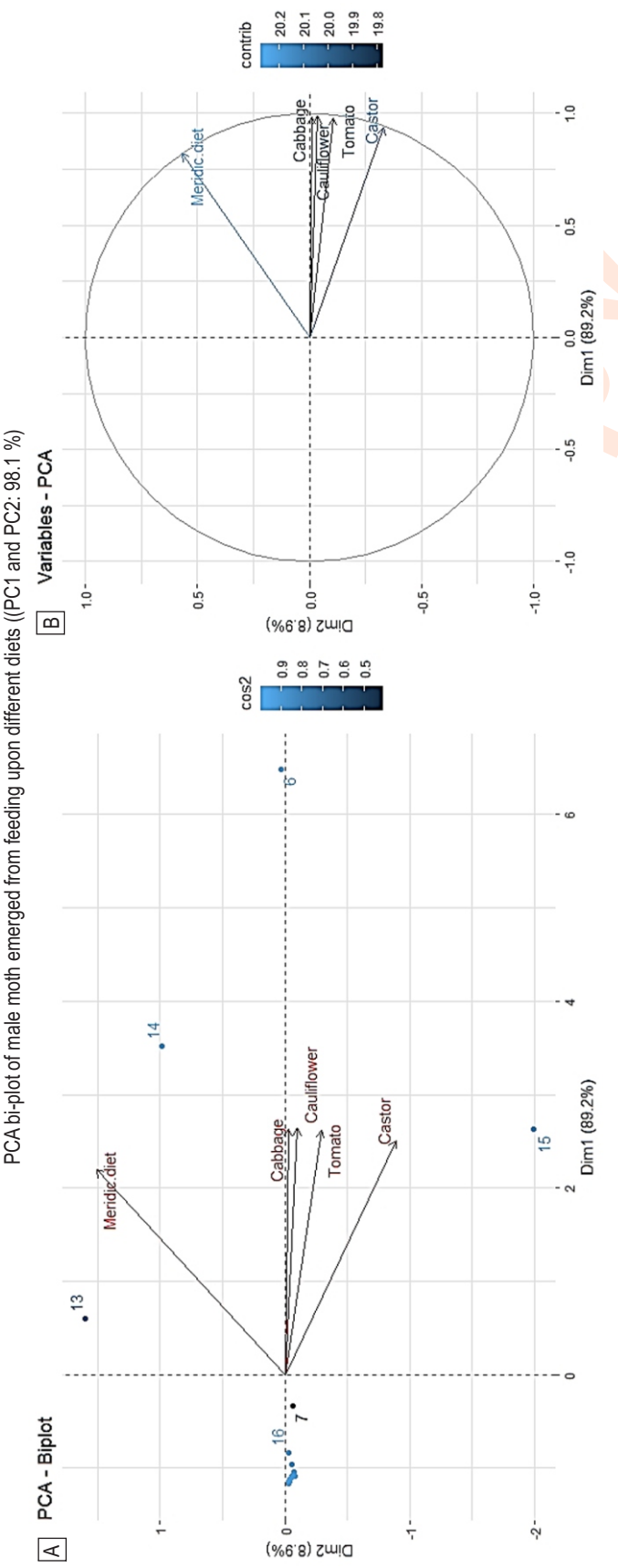

Fig 1: Principal component analysis (PCA) of scatter bi-plots co-ordinates represents male moth fatty acids biomarkers: (A) Represents variation between diets and fatty acid biomarkers and (B) represent contribution in variance.

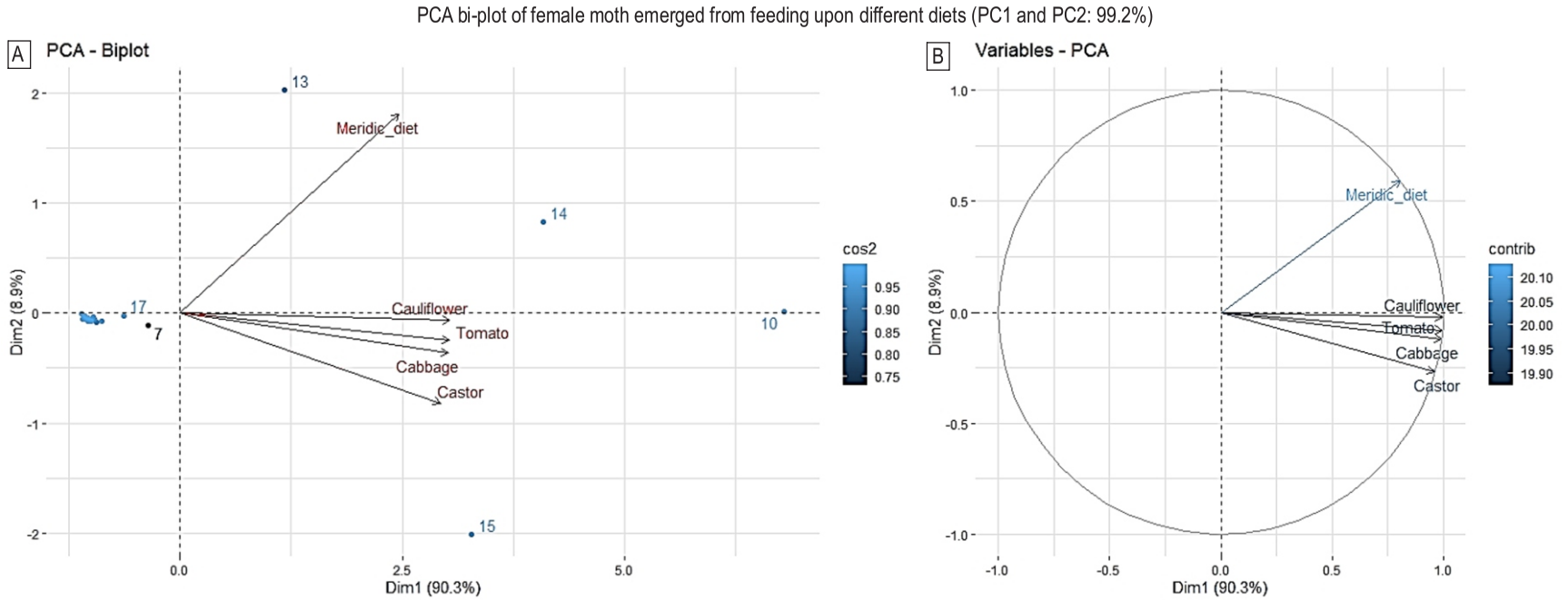

Fig 2: Principal component analysis (PCA) of scatter bi-plots co-ordinates represents female moth fatty acids biomarkers: (A) Represents variation between diets and fatty acid biomarkers and (B) represent contribution in variance.

dietary studies and in research on the mass rearing of insects.

In accordance with the results of this study and supported by previous finding, dietary differences vastly influence insect fatty acid composition and, accordingly, their nutritional status altering their reproductive potential (Ojeda-Avila *et al.,* 2003). Differences in insect fatty acid composition impact egg production, hatchability, and larval viability(Arrese and Soulages, 2010). This study clearly demonstrates that variation in the fatty acid molecule, especially the abundance of MUFAs and PUFAs in larvae fed on meridic diet, impact insect reproduction, growth and development. Despite natural hosts offering a diverse array of nutrients that result in varied fatty acid profiles compared to meridic diets, their seasonal unavailability remains a critical factor. On the other hand, meridic diets excel due to increased concentrations of oleic and linoleic acids, which enhance fecundity by supplementing essential fatty acids effectively. Artificial diets have enabled to raise a variety of insects in large number in laboratories, and also been helpful in managing of *S. litura* (Di *et al.,* 2021).

In nutshell, rearing of *Spodoptera litura* on natural hosts such as castor is more cost-effective, but its availability throughout the year is the matter of concern. So, it is practical to conclude that meridic a can serve as a substitute for rearing *Spodoptera litura* in laboratory environment, and fatty acid profile can be used as a surrogate marker to asses the reproductive fitness of insects.

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