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Research paper

Understanding grower non-participation in the collective management of carob moth in pomegranate in Iran

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ABSTRACT

The management of carob moth is a complex and multidimensional process that is only possible when collective action takes place in the pest-affected areas. The non-participation in carob moth management has led to increasing pest problems which unless managed collectively, they impose a serious limitation on pomegranate production and endanger the future of pomegranate orchards in Arsanjan county, Fars province, Iran. The current study aimed to explore why collective action has not taken place, and grounded theory was found to be the most appropriate method, followed up by a structured survey to gain an in-depth understanding of what is happening and why. Qualitative data collected through interviews were analyzed using Straussian grounded theory procedures and techniques, and quantitative data obtained via questionnaires were analyzed using descriptive statistics. The analysis indicated that individual farmers' attempts to manage carob moth had limited benefit. The results revealed that inadequate and unsupportive institutions of all types (cognitive, normative and regulative) kept collective action from occurring. The main factors impeding the participation of the farmers in the management of carob moth were: unsupportive environment for agribusinesses, low income from pomegranate production, negative attitudes towards the government, lack of cooperative culture and prevalence of individualistic behavior, and inadequate knowledge about the pest among the growers. The categories and the relationships found among them assist stakeholders in understanding the root causes behind a lack of collective action in the pest management programs. The results provide powerful lessons for other participation projects and pest control interventions.

1. Introduction

The carob moth, Ectomyelois ceratoniae Zeller (Lepidoptera: Pyralidae), is a polyphagous fruit pest widespread in many tropical and subtropical regions. It is a known pest of citrus, dates, figs, carob and almonds in Mediterranean countries (Gothilf 1984), of almonds in Western Australia (Michael 1968), of citrus in South Africa (Catling 1970), and of dates in California, USA (Nay and Perring 2005). Moreover, this moth is an important pest of stored products such as almonds, walnuts, and dates (Cox 1979; Navarro et al., 1986; Ahmad 1989). In Iran, this moth is recorded on fig, pistachio and walnut (Mozaffarian et al., 2007).

Iran is one of the world's major pomegranate producers, with about 80,000 ha area in which nearly 50 million seedlings and mature trees have been planted, producing more than 750,000 tons a year (Statistical Center of Iran, 2014). Furthermore, the high quality of this fruit in Iran has made it an important export commodity. Carob moth is a major pest of pomegranate that causes quantitative and qualitative reduction in yield in all cultivation regions of the country (Sharifi 1981; Shakeri 2004; Mozaffarian et al., 2007). In some years, this pest can cause yield losses of up to 80%, and thus constitutes a major threat to the pomegranate industry in Iran (Shakeri 2004).

The pest's larvae develop and feed inside the fruit, and this protects them from insecticides and makes chemical control inefficient (Shakeri 2004). There are various ways of controlling this pest including: sanitation (Nay and Perring 2005), sex pheromones as attractants (Baker et al., 1991), essential oils as repellents (Shakeri 2004), and the use of various resistant pomegranate cultivars (Sobhani et al., 2015). Additionally, natural enemies might play an important role in management of this pest to keep the density of carob moth below the economic injury level (Gothilf 1969, 1984; Kishani Farahani et al., 2012a, 2012b; Aleosfoor et al., 2014). However, the generally recommended procedure to control this pest is to remove infested fruits from the orchards at the end of cropping season in order to eliminate overwintering sites (Sharifi 1981; Behdad 1991). This relatively simple method is applicable but the fruits may be still susceptible to damage by the pests

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coming from neighboring fields where no control measures are taken. Actions by individual growers acting alone in cases like these can also raise new problems. For instance, if growers use pesticides that kill the natural enemies but do not effectively control the pest, the likely effectiveness of the beneficial insects in neighboring gardens decreases. Therefore, the control of carob moth depends upon treatments being implemented in a coordinated approach over a wide geographic area and it requires sustained collective action, so this in turn requires a supportive institutional environment. Collective action plays a critical role in the pest management. The latter is more effective if required institutions are in place to stimulate and facilitate coordinated or collective management efforts (Ravnborg 2004). In the current study area, several pest control techniques (e.g., removal of infested fruits, blocking the calyx end of the fruit with mud, removal of the mass of old stamens after flowering, and use of Trichogramma wasps for biological control) have been applied by growers and the government for years, but they have not been successful to control the pest because of a lack of collective action. Thus, this study aims to answer the following research question: why does collective action has not taken place to manage carob moth?

Our data guided us to use institutional theory to develop a substantive theory that could explain growers' non-participation behavior. An extensive literature details the influence of institutional arrangements such as attitudes towards participation or the way people tend to evaluate participation (Chandran and Chackacherry, 2004), water and land use rules and regulations (Vermillion, 2000), subjective norms and social norms (Defrancesco et al., 2006), participants' knowledge and skills (Salam et al., 2005), and trust between agency and farmers as well as clear definitions of roles and responsibilities (Meinzen-Dick, 1997) on participation in agricultural and rural development projects. Scott (1995) introduced three pillars of institutions that promotes or inhibits a desired behavior (participation in this study): regulative (regulations, policies, rules and laws), normative (social norms, values, beliefs and assumptions), and cognitive institutions (cognitive structures, and the knowledge and skills possessed by the people).

2. Methods

2.1. The study area

Fars province ranks first among all provinces of Iran in the production of pomegranate. Each year an average of 30 percent of pomegranate production in this province is damaged by carob moth (The Islamic Republic News Agency, 2016). This study was conducted in Arsanjan county, a major pomegranate-growing region in Fars province, in southern Iran. The main criteria for selecting the study area were high production of pomegranate as well as serious damage from carob moth. Five sites with at least 15 growers (Ahoochar, Tal Ayeshe, Khorshid Sahra, Nemat Abad and Aliabad Malek) were selected in this area. As the map shows, Arsanjan county is near to Shiraz, which is the capital city of Fars province. The overall number of pomegranate producers in the five sites was estimated to 580 in 2013.

2.2. Grounded theory

Grounded theory methodology was determined to be the most appropriate approach to carry out the current study, primarily because the method relates to the exploration of a complicated social phenomenon (Haig, 1995), by answering questions of what is happening and why (Douglas, 2004). The phenomenon of collective action in the control of carob moth, which has not received significant attention by other researchers, was the focus of the current study. Secondly, it enables researchers to generate a substantive theory that both aids deep understanding and guides effective action and practice (Corbin and Strauss 2008). The Straussian version of grounded theory (Strauss and Corbin, 1998) was used in this study. This approach was used as it provided explicit guides for systematic data analysis in order to explore key relationships. It also has much in common with social constructivist thinking (claiming that meanings and understandings are socially constructed through communication and interactions with others (Vygotsky, 1962, 1978), and is more compatible with current thinking paradigms. Furthermore, it gives attention to the broader environmental and contextual factors that influence the phenomenon. Finally, it is inductive-deductive in nature, and therefore, it acknowledges the role of existing literature and gives sufficient attention to the role of the researcher and his/her experience (Strauss and Corbin, 1994).

2.3. Data collection and analysis

Participants were recruited from multiple actors who had a stake and a say in the control of carob moth in the study area: pomegranate growers, local government officials and agents for planning and managing agriculture and water resources, informants from farmer production cooperative, and plant protection clinic members. Thirty pomegranate growers to be interviewed were sampled using the purposive sampling technique for data collection purposes. From the various purposeful sampling types, maximum variation sampling was employed. Through this type of sampling, participants with a broad array of experiences were selected. We sought variation in terms of grower's intent to contribute to the management of the pest, garden's size, age, gender, having a second job and the level of pest damage and losses. Multiple informants and stakeholders were consulted for recruiting these participants. Snowball sampling was utilized to select 10 people from other actors. The data for the current research was gathered using twenty in-depth individual interviews and one focus group interview session among pomegranate growers, and 10 in-depth individual interviews among other actors.

However, as concepts were identified and the theory started to emerge, five additional participants were interviewed to obtain further data in order to strengthen the findings and develop the theory (theoretical sampling). Sampling ended when interview responses became repetitive with no new codes emerging and no new categories being identified. The last interview revealed no significant new insights, indicating that theoretical saturation was attained. Categories covered all variations, and relationships between categories were adequately explored and understood (reaching saturation). Data collection and analysis occurred concurrently.

Most (90%) of the interviewees were men, which is a representative of the gender ratio among pomegranate growers. More details about participants are provided in Table 1.

As to theoretical sensitivity, the research team held extensive discussions on research expectations and biases, and literature was reviewed to gain knowledge at the beginning stage of the research. The data itself led us to further literature review, and therefore, we increased our literature knowledge during the data analysis process in order to compare our emerging ideas with the literature and develop relevant concepts (Strauss and Corbin, 1998). Comparison of the

Table 1
Participants' information.

Data collection method (n)	Participants	Gender		Total
		Male	Female	
Individual interview (30)	Pomegranate grower	18	2	20
	Local government agent	2	1	3
	Provincial government agent	3	0	3
	Plant protection clinic member	2	0	2
	Local leader	2	0	2
Focus group interview (1)	Pomegranate grower	9	1	10
Total		36	4	40